HEALTH ON THE CONGO

PROSSER JAMES, M.D.

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HEALTH ON THE CONGO:

HYGIENE AND MEDICAL TREATMENT IN SOUTH-WEST AFRICA, SPECIALLY THE CONGO RIVER;

COMPRISING

Familiar Letters by

PROSSER JAMES, M.D.,

Professor of Therapeutics and Materia Medica at the London Hospital;
Physician to the Hospital for Diseases of the Throat and Chest;
Consulting Physician to the Children's Home Infirmary;
Late Physician to the North London Consumption Hospital;
&c., &c., &c.

WITH AN

INTRODUCTION AND NOTES BY

REV. T. J. COMBER, F.R.G.S.

For circulation under direction of the Committee of the Baptist Missionary Society only.

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INTRODUCTION.

In view of the heavy mortality which has prevailed in our beloved Congo Mission during the last three years, it has been thought necessary to seek the best advice procurable on the subject of guarding against and treating the fevers prevalent in that country.

Dr. Prosser James (from whom, during many years, both my brothers and myself have received much personal kindness, and whom we have the honour of regarding as a dear and valued friend) has, since our mission to the Congo started, taken a deep interest in its welfare. We returned missionaries could not come too often to, or linger too long in, his consulting rooms, where, hour after hour, he has kindly and patiently inquired into our conditions of living, surroundings, and experiences on the Congo, listened to our stories of sickness and death with deepest sympathy, and shown himself most ready to counsel and advise.

Further, he has addressed to me a series of letters bearing upon our environment and its possible improvement, adaptation, and tolerance, hygienic and sanitary rules, and the treatment of fevers. This "labour of love" has taken up much of Dr. James's time, but it has been done with cheerful readiness—the outcome of the kindest and warmest interest.

Dr. James, as well as many other medical men, tell us that they are convinced that these constantly recurring deaths on the Congo should not, and need not, be. Missionaries from other tropical countries (Rev. Jas. Smith, of Delhi, Rev. G. A. Shaw, of Madagascar, Rev. Dr. Laws, of Livingstonia) assure us that our climate affects in a similar way to that of the countries where they have been living, but that, whereas in earlier years they suffered very much, they now, with their improved conditions of living and greater knowledge, can live and work with very little inconvenience from sickness.

Recent news from Congo* has brought to us workers who remain "sorrow upon sorrow," and it is not too much to say, has stirred our churches to their very depths. Anxiety and alarm on the part of our friends are inevitable, and without it indifference might be argued. Although not panic-stricken and despairing ourselves, we naturally are full of heaviness and grief, and of the keenest sense of loss—"Perplexed, but not unto despair." We have too much steady immovable conviction as to the Divine commission which sends us to carry the Gospel to the Congo, and our duty to the heathen there, to waver in the slightest degree. As Mr. Cameron writes, referring to our dear brother Mr. Cowe's death, "In a time of trial like this we must not forget that the command of the Master and the need of the heathen are alike unchanged." If we, the churches and their Congo representatives—are loyal to our Master in these seasons of trial—trial of our loyalty and devotion—He will honour our loyalty, and grant us "gain after loss."

---

* Deaths of Dr. Sidney Comber, Messrs. Cruickshank, McMillan, Cowe, and Cottingham.

A few months since the ominous whisper was heard everywhere that Congo was a land of death, and that the attempt to live there was, except in a few instances, hopeless. That conviction has given place to another (for which Mr. Stanley is largely responsible)—viz., that Congo missionaries, although devoted and earnest, are, unhappily, sadly heedless and imprudent, and court death needlessly and recklessly. The missionaries themselves, and not the climate, are to blame for early death. And while honouring zeal and ready self-sacrifice, our friends have deplored the constant imprudence manifested.

Now, we would far rather this second idea prevail than the first. For it to be believed that Congo was a land of almost certain death would make the churches hesitate in sending us forth. As to reckless disregard of life on the part of Congo missionaries, we must ask the churches to believe that it is not a tithe so bad as the strong description of Mr. Stanley would lead them to think. Cases of imprudence and thoughtlessness there have been, but not frequently, except in minor matters—little indiscretions dared scores of times with impunity, but of course unjustifiable. Were Mr. Stanley's picture (as drawn at the Cannon Street Hotel breakfast) a fair representation of cases of frequent occurrence, indeed he might say "they are mad."

To what, then, are so many deaths due? Always remembering that a specific poisonous malaria lurks in Africa—as in most parts of the East and West Indies—a malaria which, however, can be partially guarded against and combated; remembering, too, that it is to a certain extent unnatural for Europeans to live in the tropics, a change needing adaptation and acclimatisation (it is but little more unnatural for a palm or plantain to be transplanted from Africa to England); our constantly recurring losses have been due, I believe, to three causes: **over-work, imprudence**, and **want of proper medical treatment.** The first of those it was in the power of the churches to avert, when we pleaded so many months so urgently for reinforcements, and volunteers were so slow to offer. May we earnestly hope that the second (imprudence) may not obtain in our ranks in the future. Brethren, it is an honour to die for Christ in the mission field, but we want to live and do all we can for Him here. Our lives are precious, for the Gospel's sake, as well as for the sake of those who hold us in loving regard. Let us take every care of them, then, as of something for which we shall have to give account.

As to the absence of proper medical treatment, this little treatise will doubtless help our brethren to use right means to guard against and to treat fever. Had our brethren been possessed with proper medical skill, I do not think our losses would have been a fourth part of what they have been. How is it, it may be asked, we did not earlier find out these rules of health and treatment of fevers? First, our knowledge of our surroundings, of our conditions of life, of the precise nature of the evils to be avoided, is necessarily of slow and gradual acquisition, and is still lamentably incomplete, although we have learnt much that is useful. What a reversal of all generally accepted ideas as to haunts of malaria is seen in Stanley's statement that "at Equator station, with a river only five feet below its foundations, creeks sable as ink surrounding it, the ground unctuous with black fat alluvium, Europeans enjoy better health than at Manyanga, 240 feet above the river, and 1,100 feet above the sea."* "The higher the better," has been the received and unqualified instruction. But we are learning. Then, too, very much has been learnt during recent years as to reduction of temperature. Since the Franco-Prussian war a system of strong forcible abstraction of heat by the application of cold—water, in baths, packs, and in the form of ice—has been in vogue, especially in Germany, on a very large scale, with the result that in fevers mortality has been reduced one-half. Now our medical advisers recommend persistent use, with proper precautions—watching pulse and giving stimulants if necessary—of baths, packs, and occasionally strong douches. Had anyone suggested this in former years, without this good authority, we should have felt the responsibility of using such strong measures too great. We are learning. Many comparatively new medicines too—*e.g.*, pilocarpine, antipyrin, &c., have been brought into commoner use, and having won their way into ordinary prescriptions, can be used by us. To practise on ourselves and each other with new and only partially proven drugs is not right. We are rather behindhand on the Congo in our medical treatment as well as in most other things.

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* Vide Stanley's Congo and the Founding of the Free State, vol. ii., p. 320

I had no idea of writing such an extensive introduction to our little Congo vade mecum for fever. I meant but to earnestly impress upon my brethren the utmost importance of carefully studying the medical instructions given by Dr. James. If we want to teach the Congo tribes we must diligently learn their languages, and just as much, if we want to live and work for our Master on the Congo, we must all, without exception, diligently learn to be doctors. No general or superficial perusal of this book will do. It must be studied—as Butler, Whately, or Angus are studied in college—so that you can pass an examination in it with ease. This specially applies to the latter part—on the actual treatment of fever.

By the liberal gift of Mr. Charles Townsend, of Bristol, in each of your stations you will find a handsome piece of furniture in the shape of a dispensing cabinet, fitted with the drugs most approved and necessary.

Certain books have been commended to you in your outfit list for further study of medicine, as also surgery.

Let each make himself as perfect as want of opportunity for medical study at schools of medicine will allow, and be able to guard his own and his brother's life in the time of need.

And O may our Divine Master bless and help us in this matter! Whatever has happened to us in our work on the Congo, He, at any rate, has permitted. Whether in the ordering of His providence, it is His doing and His will: He knows best. Our faith has been most severely tried; we have had to trust blindly, and we "will go on not knowing" or knowing—as He wills. May He help us all to act with wisdom and judgment, teach us to live (we know how to die, if necessary; our honoured comrades gone before have shown us the way), guide us in the use of the various remedies and measures we should adopt, and, if it be His will, for the sake of His kingdom among the heathen we can ask it, preserve our little band from sickness and early death!

T. J. Comber.

Baptist Mission House,
19, Castle Street, Holborn,
July, 1885.

This little book is to take the place of the "Notes on African Fevers," printed eighteen months ago.

FAMILIAR LETTERS,

ADDRESSED TO

REV. T. J. COMBER, OF CONGO;

BY

DR. PROSSER JAMES, OF LONDON.

PREFATORY NOTE.

My dear Comber,

So you wish to print my letters now? This was not intended at first, but, if you think them of any use, treat them as your own.

As you are so pressed for time, you had better strike your pen through all superfluous matter, and send the letters to the printer. I am sorry I have not time to condense them, but will send you another letter or two on the subjects you ask about.

Believe me, with best wishes,

Your sincere friend,

PROSSER JAMES.

3, Dean Street, Park Lane,
July 1, 1885.

LETTER I.

POSITION OF STATIONS—CLIMATE.

My dear Friend,—

I am quite willing to put on paper some of the points I have urged upon you at our recent interviews. Your medical training will enable you to appreciate the hints I shall offer in a few familiar letters which you can show to any of your colleagues in your arduous work.

Before referring to the treatment of the fevers and other diseases to which you are specially prone on the Congo, let me reiterate that "**prevention is better than cure**," and if you will excuse me for saying so, it is the special duty of a missionary to take care of his own health, inasmuch as its deterioration hinders his work, and to take the lowest view of the missionary's life, its loss cannot easily be replaced.

To prevent, then, loss of health or life, the first rule is, to live, as far as possible, in the mode best adapted to maintain health in the climate and other circumstances which cannot be altered. This rule demands care (1) as to the surrounding circumstances, or, in the fashionable jargon of the day, the environment; (2) of personal health.

You cannot alter the climate of the Congo watershed, but you can to some extent avail yourself of the great variations that must exist in so extensive a region. Thus, instead of selecting stations near the river, you can, as far as is compatible with your work, choose the hill-sides. If you can only keep clear of chilly mists and other obvious dangers, the higher you go the better. You have been in the Cameroons, and must know how well some lofty mountain spot there would serve as a health-resort for the Victoria Station, which is, as far as health goes, so unfortunately located. But better far than a hill station as a resort for change would be a healthy spot to dwell in all the year round.

Still though altitude may be the first thing to consider, it is by no means the only one. Numerous conditions go to make up the complex influences we group under the term climate. The most important so far as your work is affected I will duly advert to, but before doing so would offer a word of encouragement as to climate. In many cases it has been found that what have been considered the most deadly climates owed their evil reputation largely to ignorance, or neglect of the conditions of healthy life; so that immediate improvement has followed the observance of such conditions. As an example of this, look at the West Indies. Half a century ago white soldiers sent there died like flies in autumn. A regiment of one thousand healthy men in the prime of life disappeared in about five years, and sometimes three hundred of the men died within a year. Now, such a change has been effected that service there is almost as healthy as at home. Why is this? The climate has not changed, but the men are placed in conditions more in harmony with the environment. Sanitary science has been listened to by military authorities, and every step in obedience to her injunctions has brought its reward in increased health and diminished mortality.

In India, again, the mortality (European) has fallen about half in the last thirty years, and improvement is still going on. To come nearer to your work, the West Coast of Africa will probably prove less injurious in the future. Malaria must be combated by quinine and attention to hygienic rules. Surgeon-General Gordon, C.B., who has seen much service on the Gold Coast, and in almost all climates besides, tells me that he observed that malaria became much less intense two or three hundred miles inland, as if a belt of malarious country surrounded the coast.* Dr. Robert Clarke says, "Good health may generally be enjoyed by judicious attention to a few simple rules,"† and he places temperance and exercise in the open air among the first requisites. The sun's rays he considers, are often blamed for the results of personal habits, and want of ventilation as more injurious than exposure to even night air, while much suffering was occasioned by over-feeding. These points are perhaps those on which your colleagues will not need warning; but climate has had to bear the blame of so much ignorance and neglect, that I will add for your encouragement, an extract from Lind's work on "Diseases of Europeans in hot climates." He says, "The most healthy countries in the world contain spots of ground where strangers are subject to sickness. There is hardly to be found any large extent of continent, or even any island, that does not contain some places where Europeans may enjoy an uninterrupted state of health during all seasons of the year."

---

* This does not correspond with your experience as stated at the Royal Geographical Society, April 13, to the effect that you had found malaria very intense in the cataract region, though not on the coast; but you may hope to find the Upper Congo comparatively free from this influence.

† Transactions of the Epidemiological Society. Vol. I.

That you may be able to find such places in which to fix your stations is the desire of

Your sincere friend,

P. J.

LETTER II.

ACCLIMATISATION.

My dear Friend,—

So you want to know about acclimatisation? Well, it is an old notion, but, like many others, has been rudely shaken of late years. It seems to imply an acquisition by the body of a power to resist an injurious influence. Now, it is undeniable that, to some extent, habit leads to a tolerance of things which at first produce unpleasant effects. If you smoke, you know, probably, that your first cigar or first pipe was very different to those you now enjoy. But, of course, tobacco is still a poison to you; the tolerance is limited. So we find the human body capable of accommodating itself to great variations in the conditions we bring together under the term climate; and more especially in the range of temperature, degree of moisture, prevailing winds, and other circumstances connected with the atmosphere. Thus very great and even sudden vicissitudes of temperature are tolerated or their effects may be prevented by change of clothing, and other means of varying the temperature of the body. Very delicate persons may not suffer under such circumstances; but let there be superadded to the change of temperature such movement of the air as amounts to draught or cold wind, and the strongest may be unable to resist the chill. The sudden check to perspiration—which is a sort of regulator of bodily temperature—seems to deprive the system of its power of accommodation, and other circumstances combined with variations of atmospheric temperature may be equally powerful.

But although certain poisons and medicines may be so given as to establish what we call tolerance, they do not thereby lose their noxious qualities, save in a slight degree or in a limited area. It is still possible to poison a smoker with tobacco, an opium-eater or an arsenic-eater with the drug to which he is habituated. Alcohol will intoxicate the most confirmed toper. So in the case of disease-producing influences. It is hardly *à priori* probable that any true acclimatisation, as popularly understood, takes place. Certainly there is no reason to expect that continued exposure to malaria will confer immunity from its effects.

It is true that some diseases, as for example small-pox, do not, as a rule, attack a person a second time; but your own painful personal experience assures you that tropical fevers assail you again and again, and that one attack may follow another in quick succession. It would seem as if the protection in small-pox and vaccination must arise from a change effected in the individual, and so the degree of liability to the disease varies with the constitution. I have known three attacks of small-pox in a man under thirty years of age. But such an occurrence is exceedingly rare—the protection of a single attack lasting usually a life-time. The numerous attacks of fever you have had show that there is nothing of this kind; rather do they not suggest an alliance with those diseases of which one attack predisposes to others. Some individuals do seem to possess great power of resistance to malaria, but such constitutions are rare, and we have no means of distinguishing them. Even they, too, at length succumb. I know a medical officer who served for long periods in malarious climates without suffering, but after many years, at the close of a long march, he was seized with a severe fever, the extra fatigue being apparently the cause which precipitated the attack.

You see, then, that as much care should be taken at the end of a long residence as throughout, and you must as far as possible avoid malarious spots for your stations.

But of sites anon.

From your friend,

P. J.

LETTER III.

SITES—ALTITUDE—MALARIA—VEGETATION.

My dear Friend,—

Now as to certain points in your environment on which you can exercise some choice. I have already recommended you to select hill-stations. The slope of a hill is good, as it secures the natural drainage, and even when you are quite on the top you must be particular to arrange that there is a fall away from the house. Of course water should be accessible. You have plenty in the broad stream of the Congo, but some stations will be far from its banks. A fresh spring so situated that it is not likely to get polluted should be sought to supply drinking-water. See that it is above the drainage of the premises, and take care to keep it clear of vegetable matter.

In selecting a site, the elevation and general conformation of the place are of great importance. Tablelands are generally good, but not high valleys. In the latter the air is apt to stagnate. Do not then pitch in a basin-shaped depression, however lofty. Ravines and their entrances are unhealthy; not only are they frequently full of decaying vegetation, but they are traversed by chilling winds. There is usually an up-current by day, and a down-current by night. The worst kind of ravine is a long, narrow valley, contracted near the outlet, so as to dam up the water behind.

On plains the most dangerous spots lie at the foot of the hills, especially in the tropics. The water flowing from these hills gives rise at their base to luxuriant vegetation. Sometimes such plains may be fairly healthy from the presence behind of a deep ravine, which cuts off the drainage from the hills and carries it away.

Depressions in plains are worse than on hills. Drainage is always apt to take place into them, and even a gravel basin may be constantly damp or frequently liable to become so from the water finding its way from higher levels.

High elevations lessen the power of malaria; but this means elevation above the malarious spot, for dangerous marshes are met with at great heights above the sea level. It is well known that a moderate elevation lessens the danger from a malarious district, so that the upper stories of a house are safer than those below. But a considerable height is required for security. It may even be that an elevation of 300 or 400 feet is worse than the lower plain. In some instances the malaria has been shown to ascend to probably 1,000 feet In the West Indies, sites, 2,500 to 4,000 feet above the sea, have been considered desirable—probably because there are marshes at some considerable elevation.

Most authorities think malaria will not ascend much above 1,000 feet, so that if you could get 1,200 or 1,500 feet above any marsh you ought to be safe. Horizontally it is quite probable the miasm does not spread much further than vertically; but it is certain that currents convey it much greater distances. Some think it is not conveyed in this way more than a couple of miles, unless the **current be rapid and strong**—a very significant exception. Over water, malaria, it is said, will not spread more than 3,000 feet in the English Channel; but in the West Indies it will travel over a mile, so perhaps a mile of Congo water would suffice.

Vegetation acts variously. In cold countries the sun's rays are wanted, and the removal of obstruction from vegetation often warms and dries a place. But in hot countries the protection of the shade is welcome. Evaporation from the soil is no doubt lessened by the thick covering of vegetation, but there is more than compensation. The evaporation from the vegetation itself is so enormous that large quantities of water are taken from the earth and serve to moisten and cool the air. Thus the temperature of the place may be considerably reduced. The hottest and driest places are deserts. But there is another effect of vegetation to consider: it checks the movement of the air, and when exuberant may cause stagnation. Then you may have a moist soil, covered with low, thick underwood, giving rise to a stagnant stratum of air supplied with decaying vegetation. Such spots are the birthplaces of most fatal malaria.

On the other hand, thick vegetation intercepts the conveyance of malaria by air-currents, and you may avail yourself of the protection afforded by trees. Seeing then that you have a site for your house perfectly dry all round, a thick clump of trees on the side of the most dangerous wind, or a belt of trees all round, may serve to filter the air, so to say, from distant malaria arriving on the wings of the wind. You have plenty of plantains on the Congo. Their great succulent leaves ought, I should think, to draw up a great deal of moisture from the ground, and until you can introduce the Eucalyptus, which acts in this manner, by all means keep your plantains near but not close to your house. At the same time, see that all dead leaves are removed and burnt as soon as they fall. Never let any vegetation rot near your stations. A few leaves fallen into a tank of water may suffice to set up severe illness.

In some of the hottest climates, houses are placed immediately under the shade of trees, and this may be advantageous provided the drainage be good, and the dead leaves removed as soon as they fall. You will remember, the Romans always encamped under trees in hot countries. Do not cut down trees then hastily. Take time to consider all the circumstances. But brushwood, underwood, scrub—clear it away without hesitation: it is usually worthless and injurious, though it is possible, that in safe positions, it might serve to obstruct the passage of malaria. Sometimes its removal seems to have been followed by a fresh outbreak of malaria; but this has been only temporary and provoked probably by disturbance of the ground.

Short grass, herbage is good. You may have it within your belt of trees. It cools the ground by obstructing the rays of the sun, and by increasing evaporation. In Sierra Leone, they grow Bahama grass in the streets, the occupiers of the houses keeping it cut. With the great grasses on the Congo, it will be desirable to keep them constantly cut short. You may also have a garden as well as a lawn, if well-stocked with rapidly growing or succulent flowers and vegetables. But, here I must utter a warning! All horticultural and agricultural work, without exception, must be done by natives. If you have in your band any energetic member, who when at home, boasted of his early rising and his exploits in gardening, forbid him under any circumstances to take up a spade or a hoe in the tropics. We do not send out missionaries to sacrifice their lives in emulating gardeners. You should have it pronounced a sin against your Society to undertake such work, for it is always risky, and in a virgin soil in a malarious district, to the European it is deadly. The removal of thick brushwood may be even dangerous to the natives, and should be undertaken in the heat of the day, for the greatest danger from malaria is in the early morning. You see tropical malarious countries are scarcely adapted for the European with gardening on the brain, and if anyone refuses to listen to advice on this point—why, he is not likely to trouble you long.

The nature of the soil is so important an element in the selection of a site that I must defer its consideration to another letter.

Always yours truly,

P. J.

LETTER IV.

SOILS.

* * * *

Now as to soils. Dryness is the most important point. Gravel is the best soil for building on. Avoid a luxuriant fertile soil. What is good for vegetation is bad for man. If you can find a lofty, barren or nearly barren spot, near enough to your work, there pitch your tent. "Build your house on a rock." Where coarse, tall, grasses flourish, and primeval forests abound, malarial diseases make their home. But understand, it is not the living vegetation, but the dead which, decomposing on or beneath the surface, proves so injurious.

Alluvial soils brought down by great rivers are not good. There is often an alternation of sandy and clayey strata and vegetable matter is mixed with it. The alluvium contains sometimes iron and alumina mixed with the siliceous particles, and under this perhaps stiff clay or clayey laterite. When this is near the surface malaria abounds. It may be only a foot or two from the surface, and, from what one can judge, you will have such places on the Congo. Avoid them; Europeans almost always suffer from malaria in such districts. The water in these soils is also frequently impure. The deltas of great rivers are from these causes unhealthy. The immense level, marshy tracks which appear to have been the beds of lakes or streams are also usually malarious.

All such soils are unhealthy, as are **clays and marls**, in fact all damp soils. Nothing but the most thorough subsoil drainage can make them fit to live in. If you must put up with clay, drain it well. Much can thus be done to improve it, showing that it is the local dampness which is largely to blame. Drain then all your stations ; and any that are clayey, doubly drain.

Gravels take the palm for health, **unless** they are situated so low that water rises through them and makes them damp. Gravel hills, are the best of all, and the springs at their feet are usually pure.

Chalk and **Limestones** furnish good healthy soil, if not mixed with clay ; but the lower parts are sometimes underlaid with clay, which receiving the drainage from above, renders them malarious. But alas ! I understand you have no chalk or limestone near your stations, except at S. Salvador and Bayneston. You want it badly for making lime, cement, &c. Look for it again in all directions.

Rocks—except decomposing ferruginous granite—are healthy. The water runs away easily, they are usually sloped, vegetation is not so excessive, the air is fresh and dry, as these rocks are usually elevated. When much disintegrated, forming a dark or red soil, absorbent of water, they are not so good, and will need more draining.

Slate rocks resemble granite, and are usually well sloped. Water is not injured by them, but sometimes scarce.

Sandstones are healthy and furnish a dry soil, but the water is often impure. If mixed with or underlaid by clay they may be damp.

Sands may be good or bad. When they extend to a considerable depth and are free from organic (vegetable or animal) matter, they are dry and healthy, and the water is good. When the sand is mixed with organic matter, holding the particles together, it is most unwholesome. Such a soil may be almost impermeable. Water may be found within three or four feet of the surface, and in these places malaria abound. Sometimes the water is coloured by the vegetable débris imprisoned in the soil, and if drawn from a depth of six feet may smell marshy. Such places are most dangerous. Again, some sands are, so to say, only spread over a layer of clay or laterite. Such are unwholesome, damp, malarious; and, again, sand may lie so low that water descending from higher levels rises through its particles and makes the soil damp and unwholesome.

Iron in the soil has been observed in some malarious districts, but there is no reason to suppose it is injurious. It should be a purifying agent, an oxidising salt, readily giving oxygen to organic matter and so hastening its decomposition. I was interested to hear in your paper at the Royal Geological Society that rocks containing iron were so often the seat of villages on the Upper Congo. The natives may have made good selections.

Cultivation often improves the healthiness of places, but new soils seem pernicious to those employed upon them. I have already entered my *caveat* against any of your European band engaging in gardening.

The heat absorbed by soils varies much. Sand retains the most heat. Clay much less. Chalk still less; but the glare of reflected light makes the last unpleasant in sunny climes. In our cold country we get catarrhs and rheumatism on clay and find sand none too warm. Clay always contains much moisture—about 10 per cent. of its weight is water. Even granite contains some water ·4 to 4 per cent. Dust is sometimes a scourge in hot countries, but everywhere dry soils are best. There is less disease prevalent on dry soils, and the inhabitants feel better.

Now marshes are always wet, but it is not the presence of water alone which makes them unhealthy. If so we could not escape the evil influence by residence in a ship a mile off the shore. Neither, as before said, is it the living, growing, vegetation. But the exuberant growth you see suggests that a similar production has been going on for ages—that successive crops of foliage have fallen, decayed, and sunk into the soil; so that beneath this luxuriance of plant growth the products of its death abound. In some soils the past vegetable forms may be imprisoned in a condition admitting little change, and that not injurious. In others the intermediate products of decomposition may be deadly. In the Maremma of Tuscany the organic matter amounts to about 30 per cent., and yet the changes are so slow that after all these centuries many plants are not yet destroyed.

The destructive influences at work are heat, moisture, and air. All three are always present in some degree. In the relative disproportions excess of moisture seems most pernicious. Ultimately we may imagine that the destruction may be complete and that then the soil may be healthy. It is the intermediate products, probably, that are so injurious, and this fact accounts for the improvements that take place by the effects of time, drainage, and cultivation. You see now the chief conditions against which you must guard. If a soil contains no organic matter, of course it can give rise to none of the emanations we have been considering. But very dry and arid plains often contain large quantities, and when the water reaches them disease breaks out. Many, too, contain an amount which in temperate climates would not produce wide-spread outbreaks, but under tropical heat the changes are so hastened that fevers are the result. Heat and moisture both hasten the chemical reactions between the organic matter and the air contained in the soils. In some marshes the organic matter forms as much as 45 per cent. The amount of noxious miasma that may be evolved is, therefore, almost unlimited.

Not only do the water and air in soils assist in the formation of, but they actually convey, unwholesome agencies. You will see, therefore, how important it is to keep them out of your houses. Freely as you want air to enter by the doors or windows you never want it to come in through the soil, for there it would be sure to be laden with impurities, and the water in the ground must be still more rigidly excluded. This air and water are an ever present danger.

There is always air in every soil. Even dense rocky soils contain some, and ordinary farming land will contain from two to ten times its own volume of air. Further, this subterranean atmosphere is always moving. The daily changes of temperature, the fall of rain and other circumstances affect it. Even on the driest soils it is therefore proper to prevent this "ground-air" entering your dwelling.

Water in the soil is of two kinds: first, the ordinary moisture, which is considerable. Granite and marble will contain from ·4 to 4 per cent. = a pint of water per cubic yard, while loose sand may hold a couple of gallons per cubic foot. Next there is the "ground water," a subterranean sheet of water filling up the interstices between the particles of earth. Its surface is at very different levels, sometimes being only two or three feet deep, at others hundreds. This "ground-water" is in constant movement, flowing as a rule towards the nearest water-courses, or to a lake or sea. Rainfall affects its level, so does pressure from neighbouring accumulations—rivers, lakes, seas, &c. I dwell upon the air and water in the soil because they are necessarily impure, and when they enter a dwelling they are the purveyors of disease. In tropical countries they bring fevers, dysentery, &c. At home they also bring rheumatic and catarrhal diseases.

To dry a soil is to improve it. Sometimes this may be done by opening an outflow — an engineering-problem. Sometimes obstructions to the outflow may be easily removed, the water-courses cleaned out and new ones made. But besides this, deep drainage must be undertaken. In the tropics you ought before building to drain a site, though it appears to be a dry sandy plain. This brings us to the proper preparation of a building site—of which in my next.

LETTER V.

PREPARING SITE.

My dear Comber,—

Having selected your site, clear away any brushwood, disturbing the ground as little as possible. When you intend to begin at a much later date, it might be well to sow a crop of grass over the place—or you could sow this for a good distance around, to grow during the operations. But it should be kept cut close, the cuttings being burned if not consumed by cattle. Then you proceed to your subsoil drainage. However dry the site do not neglect this. In hot countries it is as essential as in damp, cold ones. Of course, on impermeable rock it is less urgent, but then you should see that the water can flow away. Be sure in all cases to get a good fall for your drains. Choose no station where this cannot be obtained. Put your drains from twelve to fifteen feet distance from each other. Sink them from five to eight feet deep. Remember this is for subsoil drainage. The surface drainage must be separately provided for.

There should be a slope away from your house in all directions, and small shallow open drains to carry away tropical rains, or, as I shall show just now, an impermeable ground all round would be best. Pipe drains are of course best; but how are you to get them? It is no trifle to carry building materials 200 miles on men's heads and shoulders, and yet you have told me that is your only mode of transport. Well, you must make them, if possible, but of brick-making just now.

Now for the foundations. At home we excavate; but you must not do this, or as little as practicable. Do not cut away part of a hill, rather fill up holes and hollow places with dry material. Then you want a good impervious layer to keep out the ground-water and ground-air. Pavement, concrete, slate, asphalte, would do. But you have none, you say. Here again we are met with the difficulty of carriage. It seems to me you must face an attempt to make bricks. You have clay and sand and fuel. What you now need is a practical brickmaker, and it might be worth your Society's while to send one or two out, who could set up the needful machinery and instruct the natives in this important work. Such a man would select the material and make the most of it. Sun-dried bricks are very useful but much more absorbent than burnt ones.* Probably they could be glazed, and the men sent out ought to understand the glazing department and be

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[* They could be burnt in rude kilns.—T. J. C.

able therefore to make impervious tiles and drain-pipes as well as ordinary bricks. Put this proposal before the Society as one likely to save the lives of their missionaries. Be sure there are capable Christian workmen who would be ready to go. So, too, you might have sent out some good bricklayers. If you could find the right men, they would carry forward this work, teach the natives their craft, and so help you to lay broad and deep foundations for civilisation and influence.

In default of tiles, bricks set on end and joined with cement, and then a layer of cement spread over them would furnish you an excellent flooring and foundation, or concrete well laid and in the same away cemented. Here, again, is another difficulty—concrete, cement; to make these you want lime, and you tell me you have no chalk near your stations. What a find a good chalk hill would be! I fear without it you will have to import your lime. It would be awkward stuff to transport, and liable to spoil, and might want re-burning. But with it you could make concrete, and perhaps cement. Have chalk sought for then in all directions. Failing, you must see if you can have lime transported from Bayneston; but, of course, a find on the Upper Congo would enable you to bring it in the steamer down to the Pool.

If you can get enough cement you can cover all round your house (as well as under) outside for a distance of several yards with a smooth, impermeable coat, which will carry away rain-water like pavement, and can be properly sloped. Thus you will have secured the most important conditions of a healthy station, viz., a well-selected site, deep subsoil drainage, sound foundation, capped with an air-proof, damp-proof layer, and this extending for a considerable distance around. When this last is impossible, have a closely-cut lawn all round, and beyond that the belt of trees. It only remains to add that all this inner circle is to be kept free from contamination of all kinds, even while the building goes on.

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NOTE ON ABOVE LETTER.—Drainage pipes are impossible at present, but may be made or introduced in the future. Meanwhile subsoil drainage seems impossible, unless bricks can be used. Surface drainage should be carried out with brick, concrete, or cement. A strenuous effort will be made to import Cameroons or Accra brick-makers into the Congo. Glazed bricks for flooring are out of the question, I fear, but Portland cement is not, and must be tried, perhaps over a brick floor. —T. J. C.

LETTER VI.

HOUSES.

My dear Comber,—

Such a dry foundation and floor as I have recommended would in many countries only require a mat, rug, or skin thrown upon it, and would be as comfortable and as warm, as well as dry, as a wooden floor. This last, you say, is in your stations speedily destroyed by white ants or dry rot. Asphalte, or a mixture of pitch and sand, would do well in full shade, but in the sun gets soft. Try tiles, then, or, in default of these, bricks with a layer of cement, or this last over a thick concrete.

But in the malarious districts you ought not to live on the ground-floor at all. After all the care thus taken to render your floor impervious, it is not enough. I know the difficulty of building two or three stories. What, then, do I recommend? The best thing would be to build on arches over the foundations described—open arches, I mean, through which the ventilation of the space would be complete. It will, however, for a time, perhaps, be scarcely possible to get such arches constructed by the labour available. Wooden piles might be tried in some countries, but, of course, will be rapidly destroyed by insects or other agencies. You must, therefore, build up **brick piers** instead of having arches—another occasion, you see, for bricks—sun-dried ones might do for this. Use cement instead of mortar, and plaster over a thin layer of cement, and they would withstand all the destructive influences at work. Across the piers you could lay joists of wood, and then nail boards to them. The piers should be ten or twelve feet high, if possible.* This would raise your living apartments a reasonable height, and would give you underneath a dry, shady, open space easy to keep clean, thoroughly ventilated, where you could often take exercise, and could always get at the joists and flooring to repair them. In this position the wood, no doubt, would last much longer than on the ground. You could replace portions as required, and you could coat it with preservatives. Perhaps tar on the under surface would be the best thing, and you could re-tar it from time to time. You might, perhaps, in time soak your planks in some preservative,† which would prevent the attacks of insects or the dry rot; but, probably, until then tarring underneath and frequent scouring with soft soap and carbolised water would answer. Again, there are some woods which insects do not like. Inquire if any are so reputed among the natives. Some varieties of euphorbium grow on some parts of the West Coast, and are so full of the irritant gum that very few insects will attack the wood. Indeed, it is so irritant that there is a difficulty in getting it cut. Possibly you could use it in the rough for joists.* Now we go on with the

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* Half or a third this height might be possible. If too high there is considerable danger from tornadoes.—T. J. C.

† Some of these preservatives make the wood more or less fireproof.

Walls.—It is a mistake to think that very thick walls make a house cool in a sunny climate. They become thoroughly heated during the day and give out the heat all night. Some uncivilised races have found out how to guard against cold nights by putting stones to get hot in the sun and carrying them into their cabins at sunset. Hollow walls are resorted to in some localities.

Windows and Doors.—Plenty of them, of course, and so placed that you can always secure full, **through ventilation.** Hinge the upper part of windows on the lower edge, so that the upper edge may fall forwards and inwards, and direct the air upwards.

Roofing.—I think you must continue your thatch roofs. They are cool if thick enough, and the sloping ones are easily constructed by the labour which is at your service. Of course, double roofs would be very much cooler, but might harbour vermin. If you carry out my suggestion of getting bricks made, you can have tiles, and a tiled roof outside a thatched one is second to none. The chief danger is fire, and there is no doubt thatch harbours insects and snakes, but you must guard against these otherwise.

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* Posts or uprights should be charred and tarred at the lower ends where they go into the ground.—T. J. C.

Verandahs.—Always put these, as you find others do in Africa, but see that in every instance they are freely ventilated.

As to the size of your stations. Big buildings get hot and have not time to cool thoroughly in the night. Large rooms give air and ventilation without draught. Build in detached pieces therefore. Your own bedrooms and sitting-rooms should be detached from the kitchen department. The school house, dispensary, and hospital should all be detached.

Sometimes you may want to warm a room, especially at night, on a high station or during illness. The primitive plan, adopted by many on the Congo, of the warming-pot must expose you to smoke, and charcoal is rather dangerous to use. It would, however, be quite safe with a very small flue and a free draught. Much more often you want to cool your rooms. The evaporation of water does this to a great degree. The use of the watering-pot is pretty well appreciated; all round your house it is likely to be employed. When your water supply suits you can construct a simple fountain. Indoors, any sort of punkah sets the air in movement; and if wetted from time to time you get the cooling effect of the evaporation also. Perhaps some day an ice machine may be found, when you have planted civilisation firmly on the Congo.

Finally, having constructed your house, as far as possible, on proper sanitary principles, and taken up your abode and begun your work, you will have to be continually on the watch to prevent the infringement of the laws of health. The most important point is to prevent pollution of the air, water, or soil, in your enclosure. Insist on the instant removal of every impurity, vegetable as well as animal; the destruction of such impurity, as far as possible, by fire or by burial; the constant removal, too, of waste water and every source of danger. Cleanliness gone mad the natives will think; but surrounded by black servants and school boys, I know that Europeans need to be continually on guard against the dirt which native ignorance and carelessness is only too likely to introduce. The fastidiousness of Englishmen often gives them an advantage in matters of health over other Europeans, to say nothing of the African races; so, as to the entrance of any kind of impurity you may be as utterly fastidious as you please.

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LETTER VII.

PERSONAL HYGIENE.—CLOTHING.

My dear Friend,—

I have reviewed briefly your environment on the Congo. We come now to personal hygiene, and, first of all, clothing—that being most nearly related to the matters mentioned in my previous letters. I shall not say much about external clothing, for people will have their own way in this respect, and the first cardinal rule in every climate should be to clothe comfortably. For protection from cold wool is superior to cotton or linen, and it has double the power of absorbing perspiration. It is also believed to be some protection against malaria and other evil influences. Probably this is the indirect effect of guarding against chill. Protection from heat has to do with colour also. White or very light gray are the best reflectors of the direct rays of the sun, and therefore always to be used in a sunny climate. In the shade, the quality of the material, not the colour, is the point.

For underclothing then flannel is decidedly the best even in hot countries, but there are people who cannot wear wool next the skin. Flannel must not be too thick, but should be all wool. Merino contains from 20 to 50 per cent. of cotton. "Indian gauze," a light material containing silk, is better for hot countries. A flannel belt should be worn round the waist as a protection against chill. The so-called "cholera belts" seem to have been useful in this way, and may be regarded in Congo as dysentery belts. Some prefer a girdle.

Head-dress.—Regard your head-covering as a protector from light, heat, wind and rain. The army forage cap is considered comfortable, light, and is not easily blown off; it is sometimes made too small; it ought to fit so as to be carried easily on the top of the head in hot weather, or to be pulled down over the forehead and ears in cold and wind; it can be ventilated. I hope none of your band have carried a "chimney-pot" hat to the Congo. If you want to "astonish the natives" you might as well at once adopt the bear-skin of the Guards or the London policeman's last helmet. A white cotton cover, with a flap to fall over the back of the neck should be added to the cap in hot weather. It makes a difference of 5° to 7° Fahr. to the temperature inside the cap, and if kept wetted would doubtless reduce it still further. In Algeria some of the French troops wear a turban, and no doubt some form of this favourite Eastern head-dress is very comfortable and protective. Bamboo wicker helmets covered with cotton and provided with puggeries are used in India. They are light, cheap and durable. The rim should be so inclined as to protect from the level rays of the sun. A wet handkerchief in the cap, with free ventilation, keeps down the temperature, especially in a hot wind. As a protection from sunstroke, keep the head and back of the neck cool—and **white, wet** calico flowing well down the back is the best covering for the purpose.

Foot-covering.—Boots or shoes? Well, for your long walks, certainly boots. You should always stand up to be measured, though your boot-maker may not believe it necessary. Insist on his giving you length enough, generally he will make them too short. He only allows one-twenty-fourth for increase in walking, and it has been proved that the extension is often one-tenth. The expansion in breadth is even more. Have low heels, broad toes, and the inner line straight. Laces in front are the best fastening. Why do I say boots? To protect from venomous insects or serpents they must be of service, otherwise sandals, so much preferred by Eastern nations, might be better, as they are cooler and cleaner. The less covering the feet have the better, and you know how in many hot countries bare feet are preferred even on journeys. I have seen women carry their shoes in their hands down the mountains, only to put them on for appearance sake on reaching the towns. But with so many venomous creatures about, you had better wear boots.

You may want to waterproof your boots. You can do so by rubbing them with the following composition :—Half-a-pound of shoemaker's dubbin, half-a pint of linseed oil, half-a-pint of solution of india-rubber (costs three shillings per gallon). Dissolve with gentle heat ; be careful as it is very inflammable. You may have to apply it afresh in three months.*

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* Beeswax mixed with grease and used as a dressing makes a good waterproof covering.—T. J. C.

LETTER VIII.

WORK—EXERCISE—REST—SLEEP.

My dear Comber,—

Having housed and clothed yourself you are ready for your work. Now, in a state of health, within reasonable bounds, work promotes nutrition, quickening all the processes involved. Provided sufficient aliment be supplied, exercise may be regarded as invigorating the body by hastening the renewal of all tissues and the removal of all waste. Actual increase in size is familiar enough in the muscular system. The muscles in contracting accelerate the flow of blood and thus quicken the circulation which is at the same time stimulated in other ways. Oxidation is also increased by exercise. The perspiration induced is a witness of the great increase in the elimination of water. The body contains less water after a spell of work, unless the amount has been made up by drinking. In every organ there is more rapid circulation, more rapid flow of plasma, more active absorption; in a word, more rapid waste with quicker repair. The products of action are at once removed instead of accumulating. Further there is greater escape of heat by the evaporation of the increased perspiration. All this, of course, applies to moderate exercise. Exhaustion may be produced by excessive labour. Then periods of rest are requisite to enable fresh stores of material to be laid up. All this shows that under favourable circumstances moderate exercise, especially such as calls forth the energies of large groups of muscles or of many organs, must be a powerful promoter of nutrition and tend to maintain the body in health. It is desirable then, even in the most adverse circumstances, to secure some out-door exercise—and it has been found, even on the West Coast, that this holds good. The climate promotes indolence, and the sun is blamed for self-indulgence. Mind, I say moderate exercise, not hard labour. Nor can toil in a stifling school-room claim to be classed with exercise.

This brings me to another point. I have no doubt your missionary band will get through enough work. You do not go to the Congo to loiter away your lives. What I fear is you may lose them by working too hard! I have already said you must, for other reasons, avoid certain forms of labour. I now add that you must give up all immoderate work. Further, you must have your proper periods of rest. And not only repose, but sleep. Lead what some energetic Englishmen may fancy a rather lazy life, and you will really get through more work than the over-zealous recruit who thinks to carry all before him. Above all, beware of worry, which is so apt to intrude on the hours which nature has devoted to rest and sleep. I lately read somewhere that Bishop Wm. Taylor has again gone to Africa, and that he had attributed his power of work and resistance in all climates, African and Asiatic, to his strict observance of this one rule—"nothing shall defraud me of eight hours sleep in the twenty-four, and I will take absolute rest one day in seven." Now, my dear Bishop Comber, follow your brother bishop's rule as the minimum for the Congo. If you can sleep nine hours in the twenty-four, do, and an hour or two's complete repose daily, would be an excellent addition. There is a wonderful difference in individuals as to the amount of sleep they need. Perhaps Sir Ed. Coke did not need much, or he would not have advised—

> "Six hours in sleep, in law's grave study six,
> Four spend in prayer, the rest on nature fix."

Hazlitt in "English Proverbs," quotes—

> "Nature requires five hours, custom allows seven,
> Laziness takes nine, and wickedness eleven."

But you need not be deterred by proverbial wisdom, which is as often as not—error. Even in this climate the amount here allotted to laziness is not enough, and in the languid tropics you may trench on such wickedness with impunity. In Europe, especially in cities, more sleep is perhaps taken than proverbs—which are often only current in the country—imply. Kant said he could never do with less than seven hours, and Goethe confessed to requiring nine, so we can take our laziness in good company.

Extra Work.—Sometimes you say you have to take long walks, for you have no beasts of burden. Well if 500 miles or more has to be done, you are something like soldiers with long marches to do. With proper halts even 1,000 miles can be accomplished. From ten to fifteen miles per diem will not hurt a man in good health—but he will after his second or third week require an additional halt, besides Sunday. Without such rest he is apt to get out of condition, appetite declines, and the muscles become flabby. If you neglect such warning you will suffer. In this state you will be prone to fever, and malaria will be more potent. With inferior or insufficient food this condition comes on sooner, and need for rest will alone suffice to bring it on. Wet or chill is in such a state more dangerous. If obliged to trudge through a malarious district, it has been sometimes suggested to go in the afternoon, as **the most dangerous time for malaria is at sunrise and soon after.** Then again, between 11 a.m. and 2 p.m. you find it too hot to travel, and the morning has been generally preferred—always, perhaps, except for malaria. When you must pass through a particularly malarious part, which can be traversed in a single, long stage, prepare for it with an extra good meal, just as you would give a horse an extra feed of corn before a heavy journey In such a case, too, some think wine proper. But quinine is essential. Take a dose the night before and another of not less than five grains on starting. Light, nutritious food on the way should be taken. If appetite fail you can take extract of beef, or milk. On arrival, after a tepid bath or a wash and a little rest you will be able to take a meal. Perhaps I should have put the rest first. Of course, if convenient, nothing is more refreshing than a bath. But arriving in the cooler part of the day, and fatigued, there is danger of a chill. Of course it is agreeable to put on dry clothes at once, but there is such increased liability to a chill after exertion, that it may be wiser to put on your overcoat or lie down for an hour with extra covering, before washing or changing anything. A little liquid food will not spoil your next meal, but the reverse. When somewhat recuperated by this repose, including a nap if you can, get up, wash, and eat. If not, fluid food again, and another dose of quinine will be advisible.

If obliged to pass a night in a dangerous locality, the precautions should be more rigidly carried out, and great care taken to keep warm and prevent a chill.

To prevent dysenteric attacks, avoid any disturbance of the stomach or bowels. Heat-stroke is best guarded against by proper head-dress, with wet calico or paper inside, or even a green leaf; the wetted white protector descending well down the back. A judicious use of cold water to supply the place of perspiration may be indulged in. In case of attack, or an approach to it, cold affusion should at once be tried.

Take care of your feet. Many think soap or fat rubbed in before starting prevents them getting sore. The great thing is the fit of the boots, and, further, the fit of the stockings. Washing the feet with cold water is so refreshing that you will be glad to do it at every opportunity in your journeys, and there is no danger in it. At the end of the journey it is most restful. An astringent, as tannin or alum, may be used by those whose feet are tender. If anything else be used—grease. Palm oil abounds on the Congo, and none is better.

I have given you these directions as you have made such long marches, but in West Africa white men are usually carried, and in future you would do well to secure this indulgence on the Congo. It should be considered a necessity, not a luxury, and your Society would find it economical to pay bearers rather than lose their missionaries from the consequences of fatigue.

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LETTER IX.

FOOD—NUTRITION—DIET.

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In order to live and carry on work, the body must be able to repair the wear and tear which is continually going on. That, indeed, is necessary even for the processes involved in living. Hence the necessity of food—the pabulum out of which the needful supplies have to be obtained, the nutrition maintained, and energy developed.

Life may be regarded as consisting of a series of perpetual changes in the tissues of the body, giving rise to the liberation of energy or force. These changes are of two kinds—destructive and constructive. The maintenance of the due balance between these two is essential to health. Health, vital action, involves continual destruction, and this is counter-balanced by constant, compensatory repair. The products of destruction are always accumulating, and the débris must be cast off—elimination. Work increases the destructive changes, and within due bounds stimulates repair, and health is thereby promoted. But there must be a proportion between work and food, just as there must be between destructive and constructive changes.

Foods, as you know, have been differently classified. Those containing nitrogen certainly form a most important group, for that element is present in every tissue which can liberate energy, and seems to be necessary for its manifestation, though possibly after all only as an instrument. There are two groups of nitrogenous foods:—(*a*) Those which contain the nitrogen in the same proportions as albumen, and are called albuminoids, proteids, &c. (*b*) Those which contain it in another proportion — the gelatinoids—which cannot entirely replace the former group, and which have sometimes been thought to have no nutritive value at all.

Of non-nitrogenous foods we have:—1. Fats, or hydro-carbons. 2. Carbo-hydrates, or amyloids. These are the starches and sugars. 3. Certain vegetable acids.

The organic world supplies the preceding; but we also require minerals, of which table-salt is the chief, but phosphates, iron, manganese, &c., are required. Then water is from the inorganic kingdom.

A due proportion of these several kinds of food is necessary to maintain health. As much as 15 ozs. of water-free food a-day is needed for bare subsistence—that is, for the mere maintenance of the internal work of the body in a state of complete repose. But as a man could probably not exist on that amount without loss of weight, the minimum for an adult male weighing 150 lbs. in ordinary rest, only gentle exertion being taken, is calculated at 16 ozs. of water-free food—which means from 32 to 40 ozs. of ordinary solid food—as we call it.

For ordinary work a larger supply is required, and for heavy labour still more. There are other modifying causes, as individuality, variations of climate, &c. Men differ much in the amounts they consume; but it is work that makes the most important difference. Here are the amounts, in ounces, theoretically required for—

	Subsistence.	Rest.	Standard.	Hard Work.
Albuminates ...	2.	2·5	4·31	6·0 to 7·0
Fats	0·5	1·0	3·53	3·5 to 4·5
Amyloids	12·0	12·0	11·71	16·0 to 18·0
Salts	0·5	0·5	1·70	1·2 to 1·5
Total Water-free..	15·0	16·0	21·25	26·7 to 31·0

Perhaps, the third column, which is the mean of various calculated diets, should be a little more liberal. If we allow 23 ozs. for a man of 150 lbs., it would be 0·15 oz. for each lb., or nearly one hundreth part of the body-weight. This is water-free, and would correspond with 50 to 80 ozs. of ordinary solid food, to which you have to add 60 to

80 ozs. of water or liquid taken. It is desirable to observe the due proportion between the several classes of foods; especially is this the case as to the nitrogen. The best diets are said to give 1 of nitrogen to 15 of carbon. The habits and instincts of the race are in favour of a diet comparatively rich in nitrogen, and the easiest to digest appears to be one containing meat, though there are men and races who live in health on vegetable products only. In hot countries less meat is acceptable to most persons, and if you sometimes sigh for the "roast beef of old England," your goats, fowls and fish will probably suffice for health on the Congo.

But this brings us to the different forms of food, and they are easiest considered separately.

Animal Foods.

Meat is highly nitrogenous, and contains also plenty of fats and salts; but it wants starchy foods added to make it complete. Hence, a mixed diet of meat, bread, potatoes, and other starchy matters is so prevalent. The salts of meat are easily dissolved by water, so **broths**, beef-tea, etc., contain excess of salines, and sometimes very little organic matter. It is said mutton yields more to water, and that chicken broth is strongest of all. To make good broths the meat should be cut up small, put in the water cold, and warmed only, up to about 150. By adding four drops of hydrochloric acid to a pint of water with half a pound of beef, you will get, without warming, a liquid richer in soluble albumen. With a little more acid and a heat not exceeding 130° Fah., it is said you may extract nearly 50 per cent.

You may also peptonise meat for illness, as I will show later. Meats are now preserved by several methods, but the carriage to you would be the great item, and it would be better to rely on the products of the country. You have no oxen, but why should you not introduce them? I think Schweinfürth and others found the Shalooks, Dinkas, and other tribes near the equator, keeping cows. Hippopotamus beef is no doubt nutritious, but the supply is, I suppose, very irregular. The flocks of goats ought to give you enough mutton, and you may try to improve the breed.

Game.—The dark flesh of wild animals is usually rather lean, but its nutritive value is equal to beef or mutton, and more digestible. Perhaps you have antelopes and other game. Feathered game, as partridges, are very nutritious. You have them, and no doubt other birds. Pigeons, too, I know you have in abundance, and they afford a nice change. In the South of France, lazy young fellows, who fancy themselves sportsmen, shoot and eat all the little singing birds, so that you seldom hear the merry music which delights you in English country walks. The example may show that probably you may find many birds good eating, and you would not be likely to make an impression on the tribes which inhabit the vast basin of the Congo.

Poultry you have in abundance. This food is light, nutritious, and contains a full proportion of nitrogen. Its deficiency is in fat, and poultry should be rather lean, as the fat is not very nice and not very digestible. In the case of aquatic birds the fat is abundant, but its digestion difficult. Plump, tender chickens are excellent, but you want butter or bacon, or some sort of fat with them, or taken in the same meal. Rabbits much resemble poultry in quality.

Fish you have from the river. Do not neglect this excellent food. You might, too, easily dry fish. Most fresh-water fish are deficient in fat, but contain much nitrogen. Eels contain much fat, and some find it is difficult to digest. The use of butter or oil with your fish in cooking is thus obvious. In fact, **Fat** of some kind is to be added to many foods. Butter, lard, suet, dripping, are all in use here. In the South of Europe I have seen the peasantry living on olive oil and bread. Cocoa-butter is an important article. Palm-oil, nasty enough when it reaches us, ought to be as nice as butter where as fresh as it might be with you. Bacon is a tasty addition to fowl and many foods deficient in fat, and would be worth carrying up. I suppose you have no pigs. No doubt they could be kept with advantage; but do not turn them out wild, as Captain Cook did in New Zealand, where they became such a pest.

Eggs are plentiful with you and very nutritious. More than half the solid matter of eggs is nitrogenous. The yolk contains the fat, but the white is richest in nitrogen, so you eat both; and do not imitate the silly gourmand who rejected the white, as he fancied it only made the feathers. Eggs are deficient in carbon; hence, all kinds of farinaceous matter, as in puddings, are improved by them, and to those who like fatty food, bacon adds to their nutrient value. They also go well with oil in salads.

Vegetable Foods.

Grain.—What a pity you cannot grow wheat! In many rather hot countries it flourishes. Wheaten bread is always liked, contains almost all the requisites of the system, and does not pall on the taste. It is deficient in fat, which we make up for by buttering our bread, but in the olive countries they use the oil. The whole-meal has been recommended, but if you have flour taken out I should advise the best, as you will only have it for a small part of your diet, and in a dysenteric country the coarser grain might prove somewhat irritant, Biscuits you can, of course, have taken out; macaroni, vermicelli, Italian paste, semolina, &c., are prepared from hard wheat rich in gluten, some of the starch being removed from the flour. They are, therefore, richer in nitrogen than bread, and, properly cooked, very nutritious. The Neapolitan thrives well on macaroni. Of barley you would only take "pearl barley," from which the husk has been removed. Oatmeal is very nutritious, rich in both gluten and fat, and contains sugar and starch. It is not so white as wheaten flour, and will not make good bread. But oat biscuits and cakes, leavened or unleavened, are admired by many, and well-cooked porridge is the main diet of millions; mixed with Indian meal it is made into Irish **Stirabout.** Oatmeal toasted before a fire, then mixed with some fat, flavoured with salt, pepper, onion, &c., to taste, and again toasted, is a favourite dish in some parts. **Groats** or **grits** are oats with the husk removed, analogous to pearl barley.

Indian Corn or **Maize** came first from Mexico, and, perhaps, would grow on the Congo. It requires careful cooking, or otherwise it is not properly digested, and may set up diarrhœa. It is very rich in nitrogen and fat, but does not make good bread. Puddings, however, porridge, the polenta of Italians, and excellent cakes are made of it. It is recommended to soak it in water three or four hours, and then simmer well—that is, boil at a low heat for five or six hours. Hominy or cominy is maize-meal. Sugar cob or corn cob, an American delicacy, is a sweet variety of maize, cooked in the whole cob, or spike, while young and green. Oswego, maizena, corn-flour, &c., are only maize meal deprived of its harsh flavour **and its gluten** by caustic soda, and dried. You see the nitrogen is removed, and you have thus only a starchy food, which you can get better and cheaper.

Not so
Mr. J.

Rice you can get—an exceedingly wholesome and nutritious food, which careful cooking might utilise more It contains less nitrogen than the preceding grains, and therefore is taken advantageously with meats, gravies, poultry, fish, liver, and giblets, giving you, with curry or other condiments, a great variety of dishes; and with eggs and milk,—puddings, cakes, &c. It will not make bread by itself, but it is said the best Paris bread is made with a mixture of rice and wheaten flour. It wants care in cooking, as it ought not to be eaten underdone. It is best **steamed** until the grains are quite soft. Boiling for any length of time extracts some of the albumen.

Millets are said to make good bread, much used in India. They contain a little more nitrogen than rice. Have you any?

Pulses are grown and eaten over a large part of the world. With rice they form the staple food of millions in India. Arab and Hindoo alike adds lentils to his rice, and ghee when he has hard work to do. Our peas, beans, lentils, and Indian dholls and grams are all rich in nitrogen, but not in carbon, so that they are always eaten with some kind of fat. The disadvantage of these foods is that they are rather indigestible, therefore they require well cooking. They should be soaked in cold water for many hours; if old, twenty-four hours will not be too much, though otherwise the night will suffice; then crushed and stewed.

Starches.—These do not contain nitrogen, or only a trace of it. All the arrowroots, sago, and tapioca belong to this group, and though of great value as carbonaceous food must be supplemented by nitrogenous. They have the same chemical composition and nutritive value, but are distinguished by the microscopic appearances of their granules, and differ in their degrees of digestibility.

Cassava I mention separately, as it is the common food of the Congo, but it really belongs to the starches. It is in reality tapioca—the product of the Jatropha manihot. The manihots belong to the Euphorbiaceæ, several of which flourish near you. The bitter cassava is the one in use on the Congo, as you have to get rid of the bitter, poisonous principle in preparing it. It seems to contain prussic acid which would be dissipated by heat; but, besides this, there is a bitter acrid principle which gives rise to irritation of the alimentary canal, though that too is perhaps volatile. A poultice of the rasped fresh roots is said to relieve the pain caused by jiggers. You might express some of the juice and try its effects. The **meal** obtained by washing the roots and expressing the juice contains nitrogen, perhaps as much or more than potatoes. The dried root contains much more. The **starch** which is deposited from the juice is pure tapioca starch and non-nitrogenous. You see it is important to distinguish them. There is also a sweet cassava, destitute of poison—perhaps the manihot aipi, or manihot janipha. Meal, bread, starch, and tapioca have all been prepared from sweet cassava. If you have none on the Congo you might introduce it, as probably you could use the meal prepared in a way to avoid any loss of the nitrogen. As you know, the powdered starch of this plant is often called Brazilian arrowroot. Dried, and to some extent cooked on hot plates, it becomes our tapioca.

Your cassava then will not quite supply the place of our wheaten bread. It contains too little nitrogen, and some of that is lost in preparation. It will supply all the starch needed, but should be supplemented with a due proportion of the other food stuffs—fat, sugar, gravies, and meat, will go well with it. Thin cassava cakes, soaked in oil and toasted, are said to be nice—are they?

Potatoes are good starch-foods; contain very little nitrogen. With milk or fat they form an economical food. You see they are excellent to eat with meat which is too nitrogenous. The Spanish, or sweet potato (Convolvulus batatas), largely used in Central America, already grows on the Congo. Perhaps the "Hottentot fig" (Mesembryanthemum) may also be found; if not, you might introduce it.

Banana is tropical, so, perhaps, you can get plenty. It is of about the same nutritive value as rice.

Bread Fruit again affords a change—is rather more watery. Other succulent vegetables and fruits should also enter into your diet. **Salads** are too much neglected. All sorts of "weeds" may be pressed into service for the salad bowl, and, in a hot climate, must be grateful and wholesome. The cruciferæ are almost all edible, but plants of other orders are many of them unsafe.

Fruits, no doubt, suit the palate and assist digestion. As direct nutrients they are not better perhaps than cassava. Fruits which contain much sugar are much more nutritious, especially dried. Dates and bread suffice for the Arab. Figs and raisins are also good; but you must cultivate a few nice fruits to make up for the small number of indigenous ones. Unknown African fruits should not be eaten without inquiry; many are poisonous.

Sugar.—Although starches are converted into sugars in the first stage of digestion, we do not want to substitute one for the other. If for no other reason taste induces all nations to take both forms of carbo-hydrates. I understand the sugar-cane is growing near your stations, so you can probably utilise it. Sugar contains 4 to 10 per cent. of moisture; treacle, about 23 per cent. In the refining much flavour is lost; but, perhaps, you, like many others, do not possess a "sweet tooth." If you do the sugar-cane should be of service to you.

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LETTER X.

MILK, ETC.

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Milk has been described as a perfect food. For the young it is so; for they not only subsist, but grow upon milk, and flourish best when nothing is added to it. Milk contains all four of the proximate principles or food stuffs, and that in suitable proportions for the young animal. No wonder, then, that in disease, when the powers of digestion and assimilation are so reduced, the infantile diet becomes of such importance. In some form or other it also enters largely into the dietary of most nations. A cow will give twenty or twenty-five pints of milk a-day; a good goat six to eight pints. You tell me you can get plenty of goats, but they do not give much milk. This may be increased by diet, and perhaps you can improve the breed. Goat's milk is richer in solids than cow's. It would, however, be a capital thing if you could introduce a cow which could thrive on the available food. In the South of Europe they employ a small, strong cow, which will take the place of the ox in easy work, and yet is utilised for milk, though it does not give so much as our Alderneys. Destitute as the Congo is of all beasts of burden, an attempt might be made to introduce the ox—patient, laborious, and useful, if slow.*

You import condensed milk, and no doubt in sickness it is useful, particularly if unsweetened, but it is not equal to fresh; and apart from their use in health, I should recommend keeping goats in case of illness. You would thus have milk, cream, buttermilk, and so on, at your stations. Cheese probably you could not make on the Congo.

When milk is heated to boiling point the casein is partially coagulated. If the cream has been allowed to rise first it is included in the coagulum, and you have **clotted** or Devonshire cream. If you coagulate with acids or rennet, you have **curds and whey**. But, of course, set in the sun the change occurs, and in summer, even here, this is often done, and the rennet dispensed with. If a little of milk already sour be put to it, the change is more rapid. African **amasi** is thus prepared. Whey is not highly nutritious, but is to many a very agreeable and somewhat nutrient cooling drink. Skim-milk has, of course, lost a large proportion of its butter. Butter-milk is still poorer in fat. **Cheese**, the coagulated product of milk, differs in quality according to the amount of cream (butter) included.

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* A few oxen are found at San Salvador and near the river's mouth, and will doubtless soon be introduced into our upper stations.—T. J. C.

Cream-cheese contains nearly all. To make Stilton and Double-Gloucester cream is added to new milk. Cheddar is the product of new milk only. Single-Gloucester, Chester, American, etc., are obtained when 10 per cent., or more, of the cream has been first removed; Dutch and other inferior cheese when the cream has all been skimmed off.

When you add to all this the numerous puddings and other articles which are best made with milk, and its importance in invalid's diet, you will, I think, agree that it will be well to have a little dairy at each station.

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LETTER XI.

COOKING AND PRESERVING FOOD. LADIES' WORK.—LADY MISSIONARIES.

My dear Friend,—

The digestibility of various foods is greatly influenced by cooking—using the word in its widest sense as comprising every process to which food is subjected before eating. It is, therefore, of importance that you should not treat cooking as a mere question of palate. To maintain your body in the highest state of efficiency you must keep up nutrition, and it is useless to fill the stomach with food unless it can be digested. I lay stress on this, because with the diet which is available you may perhaps find some derangement of digestion. The mere change in the diet is likely to provoke some degree of difficulty, and the hot climate impairs appetite. Now, neglect of this warning will often give rise to further inconvenience. The later digestion is interfered with, and irritation propagated along the alimentary canal. Hence, perhaps, diarrhœa, or griping pains, which may culminate in dysentery—that scourge of the tropics. Perhaps many a case of dysentery begins in this way, and might be prevented by attention to diet, including cooking.

You will find natives who have learned some cooking from the Portuguese on the coast, but as you go farther they may not be willing to accompany you. Besides, Portuguese cooking at its best may not be to your taste, and is deficient in its adaption to the climate of Congo. Some people may think you should live like the natives, as though experience, as they call it, always taught what was best. By all means pick up all the information you can from the natives; but as to its being proper to diet yourself as they do, you might as well be expected to imitate them in clothing, lodging and habits—a consummation which would, I suppose, shock the good people who commend native diet.

Cooking is no doubt constantly done by "rule of thumb," and the result is often satisfactory. But when provision is to be made for new circumstances in a country where there are so many differences, a little scientific information as to the principles involved must be of the greatest value. "Rule of thumb" tells you when you boil a leg of mutton to plunge it into boiling water at first, but if you want to get broth that it should be put into cold water and stewed. But when you remember that albumen is coagulated by heat at the boiling point, and that a coagulated layer thus produced will keep in the gravy, you see numerous other applications of the same fact, and so it is in many other departments.

What is required then is intelligence presiding over the preparation of food. Here in England woman assumes the position, and perhaps it would be the best thing for the mission if a number of ladies would go out to assist you—not mere ladies, actuated by sentimental motives; but healthy, noble, young women, with their hearts in the work, and ready for self-sacrifice. There are plenty of them quite as self-sacrificing as men, perhaps more so—quite as capable of contributing to the success of the mission; and if of suitable age and constitution, quite as likely to bear the climate. But they want training, and a kind of training which your society may not appreciate.

Generally committees send out lady missionaries with the idea that they should keep schools and otherwise teach, and perhaps serve as companions "meet for the men"—*i.e.*, they go often as wives of missionaries. This may be very well in some cases, and I offer no objection to it where it comes about in the ordinary course of things. But I set before you what, if at first it seem an inferior ideal, will be, I trust, when examined, pronounced more noble and more natural. The teaching I would make a very subservient part of the female missionary's work. Let her rather set herself to introduce on the Congo the example of our English home, and to do so she may take as her own example the housewife of an earlier period, when she was expected to make innumerable things which are now in England more easily purchased. Of course she must know how to cook—not, be it understood, that I would have her stand over a fire in the tropics, I am not so thoughtless and unreasonable; but I repeat it, she should know how to cook—nay more, she should understand a dairy, be able to make bread, preserve fruits, and otherwise provide out of the material at hand for the comfort of the station to which she is sent. The country homes of England could supply any number of clever, handy, well-informed, energetic young women, capable of transforming the rough stations on the Congo into well-managed little farms, and at the same time becoming the nurses in sickness and the preparers of medical comforts for their coadjutors in the work. But to achieve this success nearly all should, as already said, be trained, and this is the training I would recommend:—

1. A short time in a first-class cooking school, not to learn, as some suppose, a variety of dishes, or even economy in making them, but rather scientific principles and their numerous applications. It might be impossible to make the dishes from absence of materials, and besides, missionaries' palates might not require tickling; but the knowlege thus gained would enable the person to contrive palatable food from very unpromising material—a production of bricks without straw, which might be of the highest value. It was said that in the Crimea our soldiers died while the French troops lived, because they knew how to cater and cook for themselves.

2. A short time in a dairy. This is very important. I have already shown you the extreme importance of milk,

especially in illness. Now, although the management of a small dairy, such as is seen on quite a small farm is simple enough, there are many practical details which are best learned by seeing them done and doing them. I am sure the time spent in this way would never be regretted. Surely there are many farmers' wives who, though they cannot otherwise help your mission, would be pleased to instruct a young lady, who had decided to go to the Congo, in all the little details of her dairy, and in such a farmhouse the visitor would learn also much about poultry, and many other branches of housewifery and household economy. Just let it be known that some missionary ladies need such instruction, and I doubt not they will at once receive invitations to come and stay a few weeks at various farm homesteads.

3. A short training in the duties of nursing, which have been so much undertaken by ladies of late years, should be added. It seems needless to supply arguments for this, the fact is so obvious. It might be desirable, too, for them to obtain more insight into medicine than is at all desirable in this country; for, on the Congo, their aid might be most acceptable in the absence of doctors, and a little judicious training would teach them to avoid doing mischief, and to sometimes add to their nursing services some useful medical help.

I say nothing of other female accomplishments and duties. We can take them for granted, but I repeat that teaching must be a secondary duty with such a missionary.

And, indeed, how can you teach the natives apart from civilising them? And tell me a more civilising—nay, I will say a more Christianising—sight for the savage than that of a happy English home, presided over by a modest, earnest, industrious gentlewoman, always ready to help native women and girls who wish to learn some of the ways which make the white man's house so different from the native tent or other shelter, some of the secrets which enable the white woman to provide from the same material nicer food, some of the thoughts which would raise their race to the level of the whites.

But perhaps you will be reminding me that the "cobbler should stick to his last," so, for the present,

Farewell from

Yours always sincerely,

P. J.

LETTER XII.

DIGESTION.

My dear Comber,—

"Revenons à nos moutons." The food must not only be cooked and eaten, but digested. Call to mind a moment your physiological study. The food, you will remember, as it passes along the alimentary canal is detained at intervals while digestive fluids are poured upon it. These take up the nutritious portions (each selecting its own), and then are re-absorbed, carrying into the system the ingredients with which they are thus charged. The liquids, however, are not merely solvents: each possesses a power of changing some part of the food by a peculiar "ferment" which it contains. These ferments are of late assuming more importance than formerly. The saliva contains ptyalin, or diastase, which changes starches into sugar—showing the importance of that stage of digestion which takes place in the mouth—especially is this the case with farinaceous foods. Malt also contains a similar ferment (vegetable diastase), and has therefore been utilised to help digestion. Extract of malt, when well prepared, is not only a nutrient, but assists the digestion of farinacea.

Gastric juice is an acid fluid. It neutralises, therefore, the somewhat alkaline saliva and suspends its action. It is not, however, the acidity only which makes it such a powerful solvent of certain foods; but it is the ferment called pepsine. This, in the presence of an acid, rapidly transmutes the proteids or albuminoids into soluble peptones, which are easily absorbed. Gastric juice also curdles milk like rennet, an effect perhaps due to the presence of another distinct ferment. You see then the extent of gastric digestion.

Pancreatic juice is poured on the chyme after it passes out of the stomach (so is bile). Now the digestion of amyloids, which was suspended in the stomach, is resumed, for another ferment, **pancreatine**, is contained in this liquid, which is alkaline, so that at this stage we have the acidity of the liquids neutralised and a process set up resembling that begun in the mouth, but much more active. Further, pancreatine not only converts starches into sugar, but it emulsifies fats. It has also some action on proteids, converting them into peptones. The importance of these two ferments is thus obvious, and while you have been away in Central Africa we have made great advances in utilising our knowledge of them. First of all we have separated these ferments in sufficiently pure form to be kept without change, or to be administered as medicines to assist digestion. Then we have studied their effects on food out of the body, and have so arrived at a more exact knowledge of the process of digestion.

Furthermore, we have demonstrated that food may be partially digested before being taken into the stomach. This pre-digestion is of the utmost importance in cases where the natural power of digestion is suspended or impaired. This is the meaning of the "peptonised" food of which you will hear more and more. A partially pre-digested food may stand between the life and death of a patient. You must sometimes almost despair when you see that one of your little band, down with fever, cannot take even milk and water, or gruels, or broths. Peptonising may then come in. It takes the labour off the stomach and presents nutriment in a form almost fit for absorption. It is common to speak of peptonising in regard to both ferments. You will understand that pepsine is to be used to digest meat and other albuminoids and pancreatine to act on starches and milk.

You have learned the use of pepsine as an aid to digestion, and need only be reminded that it must be taken with the food, preferably in successive quantities, during the progress of the meal. It acts in the stomach in an acid medium. Acting similarly out of the body, at the natural temperature, we prepare peptonised foods, and peptones from meat and other albuminoids.

To pre-digest milk we employ pancreatine, or an extract from fresh pancreas. A little of such a preparation is added to milk, together with a few grains of carbonate of soda to secure an alkaline reaction. The liquid is made warm—not too hot to sip—and soon a change takes place, more or less rapid according to the temperature. Taste it from time to time, and you find in half an hour, perhaps sometimes more, a slight bitterness perceptible. Now stop the process. This you do by raising the liquid to the boiling point. This heat destroys the ferment, and the action is not only stopped, but cannot be restored, and you can keep the pancreatised milk for several hours. If you let the peptonisation go on too long, the liquid will be too bitter and will also be too nauseous to take, and must be rejected; but if the patient is ready to take it as soon as the slightest degree of bitterness becomes perceptible, it will be found a most nutritious food. If it cannot be drunk at once, boil it a moment and it will keep till wanted.

Milk can be pancreatised without warming it, but the process is rather slower. Perhaps on the Congo you will not have ever to warm it. You will soon find how long it takes, after adding a little of the pancreatic preparation and a pinch of carbonate of soda, for the milk to be ready; but whenever it is ready, if not taken at once, arrest the process by boiling. Gruel, arrowroot, all starchy foods may be pancreatised. The first time you do this, be prepared for a surprise. Make a very thick arrowroot or gruel—so thick "your spoon stands upright in it." Stir in a little pancreatic solution—the gruel must not be too hot or the ferment will be destroyed—and you will soon see your thick stodge become thinner, until in a very short time you can drink it like milk. Here a change has taken place which to a considerable extent dispenses with the need for the digestive effort. In fact, artificial digestion has been effected—not, indeed, completely, but to such an extent as to render the completion of the process in the stomach easy. In this way you may maintain nutrition in cases which seem desperate.

You see, therefore, what a great assistance peptonisation puts in your hands. As, when solids cannot be digested, we keep our patients on liquids; so, when these last cannot be taken, peptonised, or partially pre-digested aliments, must be resorted to. Nor is this all. You know that sometimes nutrient enemata are employed to maintain life when no food can be taken by the stomach. It must be obvious to you that all such nutrient injections should be peptonised.

Papaw.—Here is something else for you. The papaw tree flourishes in most tropical countries, is in some almost as important as the banana. You must have this fruit. The natives, in some places, wrap meat in the leaves, and say this makes it tender. Very likely it does. Other tribes use it in cooking for the same purpose. The fact is, the juice contains a ferment somewhat like pepsine, and may be used instead.

Collect the juice from the unripe fruit by making incisions in it. Perhaps the natives do this, and will supply you. The juice permeates all the tree, but is only plentiful enough in the unripe fruit, which ripens after the loss. Mixed with glycerine (half-and-half) it will keep. Papain—the ferment—is precipitated by the addition of alcohol. It is very expensive here, and not very well known. If you can get plenty of the juice, experiment with it, and send me the results. Perhaps you can send some juice (mixed with glycerine), or some of your own make of papain, and some leaves. I should be glad to experiment with it further; but it is known that it dissolves fibrin, and so, perhaps, helps to digest meat; will, perhaps, do as well as pepsine. The papaw tree is the *Carica papaya* (Nat. Ord., Papayaceæ).

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LETTER XIII.

MEALS—DIET—SICK DIET.

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It is not a good plan to overload the stomach at one time and starve it another. Savages often do this, but civilised people have found it advantageous to regulate their supplies. The great point is to have a due admixture of carbonaceous and nitrogenous foods. It has been calculated that 4,300 grains of carbon and 200 of nitrogen should be consumed daily in a physiological diet. This may be distributed in three meals thus:—

	Carbon.	Nitrogen.	Equal to	
			Carbonaceous.	Nitrogeneous.
	Grains.	Grains.	Ounces.	Ounces.
For Breakfast ...	1,500	70	6·62	1·04
,, Luncheon ...	1,000	40	4·52	0·59
,, Dinner... ...	1,800	90	7·85	1·34
Total in the Day...	4,300	200	18·99	2·97

This makes dinner the principal meal, and breakfast the next, luncheon being only half as much as dinner. If you say luncheon is about one part, breakfast may be reckoned at one-and-a-half, and dinner two. As your usual meal times in Congo are 6 a.m., 11 a.m., and 6 p.m., these proportions will suit well. I understand it is customary to take a cup of tea in the afternoon, and sometimes another in the evening. There is no objection to this, provided you make it weak.

You will observe that in this scheme breakfast is a more important meal than luncheon. This is intentional. After the night's rest, the stomach should be ready for a good meal to prepare you for the work of the day. Some of your recruits may fancy they do not require a good breakfast so early. Tell them it is necessary; that he who cannot eat his breakfast is unfit for duty, and had better lie in bed. Let this be a law of your band—he who will not eat, neither shall he work. With dinner at five or six o'clock, you ought to be ready for your breakfast, and ought not to go to your morning's work without it. You will, no doubt, meet with some men who will say they never have an appetite in the morning. This may be from habit acquired before going to Africa; or because they take late suppers, or drink wine with dinner or afterwards, or smoke too much, or go to bed too late, or because their health is failing. Thus it may be only necessary to correct some fault in order to make the morning meal welcome. In other instances it may be advisable to rise half-an-hour earlier. In other cases it may possibly be that insufficient nutriment is taken or digested at dinner, and that debility, instead of increased appetite for breakfast, is the result. The remedy for this condition is—not, too heavy a dinner, as that may not be digested, but a little light refreshment later on ; just as sleeplessness arising from the same cause is removed by a biscuit, a glass of milk, or a little gruel on going to bed, or even in the night.

Let it be understood, then, that a good breakfast is desirable, and that no one is to begin work on an empty stomach. If you occasionally feel a positive repugnance for your breakfast without obvious cause, look upon it as a symptom of indisposition ; stay later in bed, and take some liquid food to recuperate your exhausted energy.

Some nations prefer only two meals a day, but the interval is generally too long for weakly people, and you will do much better to adhere to three on the Congo.

Sick persons, who are not too ill to walk about, should, as far as practicable, adhere to their usual meal times. When solid food cannot be taken, we return to the simplest liquid food—milk, beef-tea (in the tropics this is specially apt to cause diarrhœa), broths, gruel, etc. When there is any difficulty with these, peptonise them. More frequent feeding is necessary when a patient is confined to slops. Then there is no need to take a quantity at once ; to do so will often set up distress, and so defeat the object. A considerable amount of liquid aliment may be taken in twenty-four hours if given in very small quantities and often. Two or three ounces every hour will be taken when more would be rejected. A teaspoonful every five or ten minutes has sometimes been given for days together with excellent results.

With regard to fever diet, the old notion of starving has been completely discarded. Graves desired for his epitaph, "he fed fevers," and the great waste that is going on in the febrile state calls for nutrients to supply its place. The great difficulty is the inability of the patient to digest his food. He is of course reduced to liquids. Milk and beef-tea are the two staples of his diet, and sometimes neither can be retained, much more digested. Pre-digested fluids must be tried, and this is why I have said so much about them. In the fevers of the tropics and in the dysenteric attacks too, they afford you the chance of maintaining nutrition. When your dairies are ready the ladies who do not disdain the work will soon become expert in peptonising the milk, which is a very simple operation. Goats' milk can be treated just as well as cows', so keep a flock for a time. If compelled to resort to preserved milk the unsweetened would be best, but get your dairies as soon as possible. We talk of beef-tea, but some other animal broth must be substituted. Do not suppose that Liebig's extract represents the meat; far from it. It is a condiment and a stimulant, very restorative after fatigue, and may no doubt be useful if we do not expect too much from it. Some peptonised preparations might be also sent out. Further, could you not preserve and peptonise meat yourselves when it happens to be plentiful? I am sure the dairy women I am recommending you to enlist would soon learn to do so, and to utilise perhaps, papaw.

NOTE.—Re Diet.—It has been found to be a most important thing on the Congo to live well; *i.e.*, to have good, tasty, well-cooked, and appetising dishes. Wherever economy comes in it must not come in here. Where possible, a choice of several courses, including soup, is desirable.

This necessity for good living cannot be too strongly urged, and it is usually possible. T. J. C.

LETTER XIV.

WATER.

My dear Friend,—

In a former letter, speaking of soils, I have incidentally pointed out some of their effects on water. Though you are removed from the thousand and one dangers that beset us from our water, there are some perils incident to your life from this source against which you must always exercise vigilance. The water from granitic rocks is generally excellent, so it is from hard oolite and millstone grit. The soft sand-rock imparts an undue proportion of mineral matter. Gravel usually furnishes a good supply. Sand may be good or bad—often the latter. When it abounds in organic matter, the water will take it up and cause fever. The water from clay soils is, for the most part, only surface or sub-soil water, and, therefore, always to be regarded with suspicion, as likely to be loaded with organic matter. Water of marshes you will look on as simply poisonous. Shallow wells are often only the points to which the surrounding district drains and heavy rains are apt to wash impurities into them. A well which passes through a stratum of clay or hard rock is a "deep" well in this view, and usually a safe one. Norton's tube well (which is only a small iron tube, in lengths, driven into the ground, the lower end being perforated with small holes for the water to enter) has often been of service, though in some cases the holes may get clogged by sand. You might be glad to try it. River water is more complex in its composition from its many sources, and differs according to the season, and the probabilities of contamination must be taken into account. Rain-water is very pure, but is, of course, liable to be contaminated by the surface from which it is collected, and then in the tanks in which it is stored. On the roofs of houses decaying leaves, soot, bird-droppings, and other impurities are present. In the reservoirs, these and other things must be guarded against. When you get rain-water, and, I suppose, in the tropics this is not always, though in Guinea I hear rain supplies all the water, you may do well to utilise it for drinking, particularly if you have reason to suspect your other supply. It will act on both lead and zinc. Well-charred barrels would make good reservoirs, but they must be covered, or leaves (or worse) will find their way in. An eye must always be kept on your reservoirs, for disaster has followed the access of even small quantities of leaves or other impurities.

To purify water.—Boil, filter, and treat with alum and permanganates. These are the three things most within your reach. Some others are useful. Now as to these first. **Boiling** removes lime and gases, as well as much organic matter. It is probable that boiling also destroys the poisons of some specific diseases.

Filtering removes suspended impurities. Sand will do for this if the sand be perfectly pure. Charcoal is better. Vegetable charcoal may be of some service, but animal charcoal is infinitely more efficacious. You should make some for this purpose; purify it, and every now and then give each filter a fresh supply; or if it is difficult, you can re-burn the charcoal of each. The charcoal acts chemically as well as mechanically. It removes a good deal of organic matter, but can scarcely be depended on to destroy disease germs. It soon becomes saturated, and therefore must be renewed from time to time. The water should not be left long in contact with the charcoal, lest it should again take up the material which had been removed. You might construct yourselves very cheap filters of pure sand with a layer of charcoal in addition, and by changing the filtering media every three months, secure yourselves from several dangers. By previously boiling the water, you would be safer still.

Alum, in the proportion of about six grains to a gallon, has been used to purify water for many centuries in China and India. It is very useful when carbonate of lime is present, as decomposition ensues, and a precipitate is caused which carries to the bottom floating impurities. It can then stand to clear, or may be filtered.

Permanganate of potash, or soda, or Condy's fluid may be added. It oxidises many organic matters, and removes the smell of stored water. Sometimes a yellow tinge is left from the finely divided peroxide of manganese remaining suspended. This is probably not injurious. A little alum will often carry it down; if not, you may filter. When there is any odour in the water, Condy's fluid should be used—*i.e.*, if no other water can be obtained. Add it teaspoonful by teaspoonful to every three or four gallons, until a faint pink tinge remains; then wait five or ten minutes. If the tint has disappeared, add more by half-spoonfuls until you get a permanent tinge. Let it stand six hours, then add the alum (six grains per gallon), and let it stand twelve hours or more. Permanganate is sometimes used to cleanse filters—a solution being passed through until it comes out without loss of colour. But it is better to heat the charcoal (under cover) to redness first.

When water has to be stored, it is well to char the inside of the cask. This has been found more efficacious than putting charcoal in the water, and the charring may be repeated from time to time.

Agitation and exposure to the air in divided streams promote oxidation, so that the water of a fountain should be improved. Any device to pass it through the air finely divided may be utilised, *e.g.*, pouring it through a sieve from a height. This plan has been tried on the West Coast and in Russia; but I would advise you not to trust to it alone, but rather to treat with permanganate and alum, boil and filter.

Perhaps the natives have some vegetable substances which they utilise as purifiers of water, such as the Indian "clearing berries" (N. O. Sapotaceæ).

Distilling.—Pure water can be obtained by distillation, and in your stations you could easily fix a simple still, which must not be used for any other purpose. It is not so nice—the flavour being all removed; but in some cases this would be a minor consideration, and you could aërate it by pouring through a sieve. The addition of a thin slice of lemon to every two or three quarts, leaving it to stand all night, imparts to water just enough flavour to make it refreshing and agreeable.

Diseases produced by impure water.—I have dwelt so long on water, because just those diseases your band has suffered from may be propagated and perhaps produced by its impurities. Indigestion will occur in various forms from very "hard water": the mineral matter, though some is desirable, when in excess affects both stomach and bowels. But organic impurities, both vegetable and animal, are more dangerous still. Diarrhœa, dysentery, and other affections of the mucous membrane may be traced to this cause. So, too, the fevers from which you have suffered may be conveyed in the drinking water. In fact, in any sudden outbreak of malarial fever, especially if the cases are severe and not easily accounted for, look to the water. Some most malignant cases seem to have been induced by a draught of marsh-polluted water. If in doubt, when such a case occurs, give the patient distilled water, if you can get it; if not, rain-water may serve, but change the supply, at least; also treat as above and boil. The fact that, in dangerous districts, those who drank cold water have suffered, when those who only took tea and coffee (that is, boiled their water) escaped, may be due to the boiling of the water having destroyed the organic matter. Cholera is believed by many to be carried chiefly by water. You do not get this, it seems, in Africa; but dysentery is too common, and there seems no doubt that impure water may convey this as well as all your tropical fevers. The entozoa, too, may gain admittance to the system in the water.

LETTER XV.

BEVERAGES.—DILUENTS.

MY DEAR FRIEND,—

Of course, water is the basis of all our beverages, whether simply diluents or nutrients. I have shown you the importance of boiling water whenever you have the least suspicion of its purity. Beverages prepared with boiled, if not with boiling water, will be safest in the tropics, especially for invalids. Even saline drinks, and those taken cold, should be made with water which has been boiled. Mucilaginous beverages, such as oatmeal-water, barley-water, and other demulcents, are to some extent nutrient, as are also saccharine drinks. Milk, beef-tea, broths, &c., are, rather, liquid foods. Tea, coffee, &c., are always made with boiling water, but when drank cold should not be left to stand on the leaves, but poured off and set aside.

Tea is, perhaps, the best of all beverages for hot countries. In India, Jamaica, and other places, tea is the favourite beverage when hunting and taking other exercise.

I can recommend tea provided you do not make it too strong. You may take it hot or cold according to taste, but warm is most popular.

Coffee is, perhaps, more exciting, is "heavier," and less suited for the tropics, though some of you may find it agree with you better. As coffee grows wild on the Upper Congo you should have no difficulty in getting it gathered and and dried in the sun. You could then roast it as required, and as the perfection of coffee can only be secured by fresh roasting every morning, the probable inferiority of your berry to Mocha may be to some extent compensated for by daily roasting. After a few failures, your people will become expert, for the art of roasting is easy, and then you will be able to command a cheap, wholesome, refreshing beverage. Tea, so much lighter, will be more easily imported.

It is generally supposed that these beverages retard tissue changes, and in this manner diminish waste and abate heat. At the same time, they excite nervous action, thereby rendering work easier, whether physical or mental, but particularly the latter. To the cerebral excitement is due the cheerfulness commonly attributed to "the cups that cheer but not inebriate." So is the wakefulness and persistent thinking which follows these drinks when too strong, and troubles some susceptible persons after even moderate amounts of weak tea, coffee, &c. Poisonous quantities expend their energy on the nervous system.

It seems that tea increases the action of the skin more than coffee, which has been supposed only to stimulate the kidneys; but, probably, any drink taken warm promotes perspiration, and so indirectly diminishes the heat of the body. Is, then, the popular notion, that warm tea cools, correct? or is that idea only the expression of thirst, and the water, not the tea, the cooling agent? Any pleasant-tasting liquid is grateful to a hot and thirsty person, much more to a patient parched with fever. The cool sensation imparted by cold liquids is in itself most grateful, while warm beverages also act by their indirect effect on the skin, for the simplest hot drink will often at once provoke perspiration and so afford relief.

Many people insist on making tea, coffee, &c., too strong, and then attempt to modify the effect by adding sugar and milk. This is a delusion. You know that the action of medicinal infusions is not prevented by such additions. Well-made tea or coffee, if very weak, is quite as refreshing as, and as soon as the taste is acquired, more agreeable than, stronger infusions of which the taste has been disguised. Where milk is scarce, this is worth remembering.

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LETTER XVI.

ALCOHOL.

My dear Comber,—

You ask me about alcoholic beverages. Well, first of all, I heartily wish that they had been forbidden to be introduced into the new Congo Free State. Considering that the native tribes of so many countries have disappeared before the deadly influence of the "fire-water," it would, perhaps, have savoured less of cynicism when the **Christian** powers who met in conference to divide the Congo country amongst themselves, according to the

> "good old plan
> That they should take who have the power,
> And they should keep who can,"

had they proposed, for the sake of the blacks, to prohibit the introduction of intoxicating liquors into the new State; but that would have been a restriction on trade, and the good of the natives could never be allowed to limit the right of **Christian** traders to sell degradation and death.

So, while diplomacy admits the black as "a man and a brother," commerce exults over another customer; and the cry of you missionaries that he has a soul to save is drowned in the shout of the dealers in degradation that he has a stomach to fill with liquor. The loathsome tale of the white man's fire-water has so often been told that the Congo might have been spared its repetition. Even now it is to be hoped that the newly recognised Free State may acquire the right to tax and exclude that which is likely to be a terrible curse.

But this is not the question you would ask me. Rather, you would know whether wine may not be sometimes useful to whites in the tropics. As a medicine the use of alcohol is, of course, unaffected by the question of its value as a beverage. Its medicinal effects should be studied and measured as are those of other drugs. As a beverage in hot countries the evidence is very conclusive against all but the weakest wines. All the best authorities concur in the conclusion that heat is not borne so well when alcohol is taken, while sunstroke is more likely to occur. The most celebrated army surgeons have pronounced against alcohol in tropical service, and on marching in India, the West Indies, Africa, and all hot countries. Sportsmen in India generally support the same view, and find warm tea the best beverage on hunting excursions. In numerous marches in India and other hot countries the soldiers who were teetotallers were more healthy and vigorous than others. All this shows there would be nothing to lose by the exclusion of alcohol from the diet of white men in the tropics—probably much to gain.

On the other hand, it is held that there are times when a small quantity is of special advantage. For instance, when exhausted by great fatigue, and yet compelled to renew exertion, a single glass of claret with beef-tea or a couple of spoonfuls of extract of meat is a reviving dose, and may help you over the difficulty, but, of course, not without a heavy demand on the system, especially on the heart. The proper restorative in such a case is rest and food. When rest cannot possibly be had, wine may assist food, but enough ought not to be taken to cause drowsiness or much quicken the pulse. It is sometimes thought alcohol will make up for deficient food. This is a dangerous notion. No doubt it may keep up the action of a failing heart for a time, and it may deaden the distress of fatigue; but it should rather be resorted to for the purpose of inducing the person to take food and, perhaps, assisting its digestion—that is, more as a condiment than anything else—and therefore only as an accompaniment of food.

With regard to malarial fevers, dysentery, and other tropical diseases, it cannot be said that we have any facts in support of the notion that alcohol is a preventive. Neither can it be shown that those who take no alcohol resist malaria better. Probably the presence or absence of alcohol in the blood during exposure to malaria has no influence unless the amount is such as to diminish the quantity of nutriment taken or assimilated. And it is to be remembered that whenever it impairs nutrition it increases the liability to disease. On the other hand, perhaps, we must admit that weakly persons or invalids whose appetite is failing may derive some benefit from small quantities of the weaker wines or beers taken with the food, provided they enable them to take or digest more nutriment. It should be understood, however, that it is the increased amount of food supplied or digested which is the agent for good. That other digestives may be more efficient would seem a natural conclusion, and there is this disadvantage in the use of alcoholics as digestives—they do not cure the dyspepsia for which they are taken. They are pleasant to the palate and therefore willingly taken. They no doubt relieve for the time being various uneasy sensations, and even blunt the sense of pain and weariness that attends indigestion and other ailments, and so for the time they may serve a certain purpose, but they do not prevent the recurrence of the morbid phenomena; they do not postpone their approach; they do not mitigate the next attack; they do not tend to cure the malady, and so they are not discontinued. How unlike the effects of quinine on malarial diseases which it cures, and even when it fails at once to arrest the paroxysms, it tends to prevent their recurrence!

PART II.

LETTER XVII.

DISEASES ON THE CONGO.

My dear Friend,—

I proceed now to what you may, perhaps, think the more practical part—the therapeutic—the treatment of the most prevalent African diseases after they have appeared. I have before me your own "notes" on these maladies, and will take them in the order you have adopted. This will enable you easily to compare what I have to say with your own observations.

You mention Intermittents, Remittents, Diarrhœa, and Dysentery. Now, these may be all regarded as malarious. Of the fevers you have no doubt, but you do not allude to it in regard to dysentery. You may take it for granted that tropical dysentery is almost as closely connected with malaria as the fevers.

I have in former letters said a good deal about malaria, but the importance of the subject in relation to these diseases induces me to sum up for you some points which deserve your attention. The malarial poison is telluric; it is generated by the soil—is earth-born. Generally it appears in those soils which are not cultivated, as if healthy vegetation consumed the energy which otherwise is expended in producing malaria. Hence, after malarial districts have been drained and well cultivated they become healthy. Chemists have not been able to detect the poison. Our knowledge of it depends on its pathological action, but this has been recognised from early ages.

In 1879 Tommasi-Crudelli and Klebs announced that they had discovered a microscopical fungus in the lower strata of the air, in the stagnant water, and in the soil of the Roman Campagna, where pernicious fever is endemic. This **Bacillus malariæ**, as they named the fungus, they cultivated artificially in various soils, and experimenting with it on dogs produced fevers and enlarged spleens. A different bacillus was subsequently described by Laveran (*Lancet*, 1883), and quite recently by Marchiafava and Celli, who report that they have succeeded in finding the animated filaments described by Laveran in the blood of patients suffering from malarial fever, and further, that by inoculation with these filaments, they have produced intermittents precisely like those observed in men exposed to marsh miasms.

Speaking of marshes, it may be said they are not dangerous when well covered with water. But as soon as the water-level falls and the soil is exposed to the sun, they become deadly. The sun's rays then appear to develop the poison in large quantities from the damp soil, or rather from the organic matter with which the soil is saturated.

Yes; it is quite true that malarial fevers are found in some dry and even sterile districts. Deserts, however, may not always have been in the state we now find them. Indeed, we know that many of them have been fertile enough, and they only want water to "bring forth abundantly." In Southern Europe there are many districts which are healthy in the rainy season, when they are completely covered with water; but as soon as this has sunk low enough for the drying process to begin the poisonous emanations are evolved. So it is easy to understand why disturbance of the soil in malarial regions is so dangerous, although afterwards, when the ground is reduced to thorough cultivation, the diseases at first aggravated may be mitigated or banished. Drainage and high farming will exterminate malaria.

Temperature exercises an important influence in increasing the activity of malaria. Some places may be safely visited in the cold season which are most dangerous at other times. With a low temperature marshy districts are less dangerous than in hot seasons. When the medium summer temperature has not reached 59° F. in temperate climates in certain places there has been a great decrease in malarial disease.

You will, perhaps, meet with some persons who have taken up with Dr. Oldham's hypothesis, that the diseases we attribute to malaria are all due to "chill." I read his book with much interest, but scarcely with conviction, when it first appeared, now a good many years ago. There are interesting facts recorded, but perhaps none that cannot be accounted for on the accepted theory. If paroxysmal fevers are produced by "chill," how is it that in our "chilly" climate anyone escapes them? Other results of chill—rheumatic and catarrhal—like the poor, "we have always with us"; but intermittents and dysentery—why, they appear in certain spots and are driven out by agricultural and sanitary improvements.

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LETTER XVIII.

INTERMITTENT FEVER OR AGUE.

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Intermittent fever is the typical form of paroxysmal disease caused by malaria. It comes on with a sudden rise of temperature, which, after a time, as suddenly falls, and the period of intermission ensues. The complete paroxysm consists of three very distinct stages—the cold,* the hot, and the sweating, which always observe this order. After the third, or sweating stage, there is a non-febrile interval, or apyrexial period, in which the patient may feel quite well. This lasts a certain number of hours and its duration gives the name to the fever as **quotidian**, which recurs every twenty-four hours, **tertian** every forty-eight, and **quartan** every seventy hours. When there is a paroxysm of the same duration and severity, but returning on alternate days, it is called double-tertian. Sometimes less regular types are observed, *e.g.*, **triple tertian**, in which there are two paroxysms in one day, followed by one the next day; or **double quartan**, in which there is a paroxysm one day, a less severe one the next, and an intermission the third day. The quotidian is the most common type. The quartan, though the rarest, is the most obstinate.

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* The cold stage is sometimes entirely absent in Congo intermittent fever.—T. J. C.

Premonitory symptoms, as in other febrile diseases, are often observed, such as languor, pains in the back and limbs, headache, loss of appetite or derangement of digestion, perhaps nausea or vomiting. In some persons disturbance of the nervous system is more prominent, and they will recognise unusual irritability and loss of temper, or depression of spirits and lethargy as precursors of an attack.

Cold Stage.—This, which is called the "chills" or the "shakes," may be very violent or very slight, sometimes even absent. It may last four or five hours or only as many minutes. If well marked, there is shivering, becoming quickly distinct rigors, until the patient shakes and his teeth chatter, though blankets may be heaped upon him and hot bottles placed in the bed. The nails turn blue, and the skin is shrivelled and emptied of blood. But all this time, though the patient is distressed with the sensation of cold, he is in a state of fever; his temperature is rising, and the clinical thermometer will indicate two or three degrees above normal. The pulse and respiration are also both more rapid; the tongue is furred, appetite gone, and other indications of gastric derangement mostly present.

Sometimes the onset of the cold stage is very sudden and decided, but in other cases it is so slight as to be almost unnoticed. The latter is scarcely a good sign: it is more common when the patient has been exposed to very virulent malaria, or has been exhausted, or is peculiarly susceptible—as if, when the disease is severe, the process is more rapid, and the second stage hurried into before the first had been well established.

Hot Stage.—At length the blood returns to the surface, and a general sense of warmth comes on. This soon becomes excessive; the skin feels hot, the face flushes, and the patient feels the discomfort and restlessness observed in all fevers. The pulse rises in frequency and fulness, the tongue is dry, often tinged with bile, the bowels are constipated, and there is weariness and pain in the limbs, head, and back. The temperature, which, as I have said, begins to rise from the invasion of the disease, will generally be 101° or 102° Fahr. by the time the hot stage begins, and then it will run up rapidly to 105° or 106°, and sometimes even to 107° Fahr. The hot stage will last from half-an-hour or three-quarters to an hour or a couple of hours, varying with the treatment, the condition of the patient, and the variety of the fever. Sometimes, however, it is much more protracted, extending over twelve to twenty-four hours, greatly aggravating the distress and danger of the patient.

Sweating Stage.—At last the skin yields, the face, brow, and hands begin to feel a little clammy, and then perspiration breaks out over the whole body, and lasts from two to eight hours or more. Then the patient is greatly relieved, and often feels quite well, or only a little fatigued. His fever has passed by, and he may sleep tranquilly. The fall in the temperature is very remarkable. As soon as the sweating stage sets in the decline may be noticed. The fall is at first slow, but very soon it is as rapid as the rise had been. It will even descend one-tenth or one-fifth of a degree **below** the normal, and remain there during the intermission, which now succeeds. On the other hand, the tendency to febrile heat at the period of the paroxysm is very persistent, so that when the attack has been prevented by quinine, the thermometer will often rise at the hour of recurrence, even though the patient may not be sensible of any change.

Malignant Agues.—The foregoing description applies to ordinary intermittent fever, such as we see in Europe. Even here, however, we meet with more serious cases, some of them deserving the name of malignant or pernicious; some becoming remittents and others being complicated by other diseases, chiefly of the digestive or respiratory organs, such as diarrhœa and dysentery, or bronchitis, pneumonia, and asthma. Pneumonia is a specially dangerous complication, very liable to attack persons coming home from the tropics; it is often rapidly fatal, and if not is apt to set up pneumonic phthisis. These very serious cases of intermittent fever have been carefully observed in Italy, France, Algeria, and the Tropics. They were more common formerly, and it is probable that the lowering treatment adopted may have had something to do with this. You will be likely to meet with these cases, which are most apt to occur from exposure in dangerous districts, and where the type of the disease becomes remittent.

The consequences of an attack of simple, uncomplicated ague may not seem serious. The attack itself may be very mild ; there is little or no danger, and the patient may rapidly recover. A series of even mild paroxysms, however, may lead to deterioration of the health, and, inasmuch as the disease is characterised by a marked tendency to recurrence, every attack is to be regarded as predisposing to another. Each is a step towards the "shattered constitution" which is summed up as "malarial cachexia," and which is sure to be reached unless care and active treatment are interposed. Under the blighting influence of unrestrained ague the complexion loses its healthy tinge, becomes muddy, sallow, yellowish, or brownish—the patient manifestly ages in appearance. Anæmia is produced, perhaps only slowly and steadily, but sometimes with amazing rapidity. An enormous increase of leucocytes, with a corresponding decrease in the red corpuscles of the blood, has been known to occur within twenty-four hours, and other changes in the blood have also been observed ; naturally anæmic murmurs in the cardiac region and over the great vessels may often be heard. The gastric powers are impaired, and indigestion or diarrhœa set up from slight causes. The liver sympathises and often enlarges; but the organ most affected is the spleen, which so frequently suffers that its enlargement is known as "ague-cake." This organ is softened as well as enormously enlarged, and is easily ruptured by mechanical force, so that slight blows on the abdomen have in this way been fatal. The respiratory organs are apt to be attacked in these cachetic patients, and pneumonia is a very dangerous complication for them. The urine is often albuminous, and with this there may be anasarca of the lower limbs; but you need not conclude that this is Bright's disease, for such cases often recover under appropriate treatment or change of climate. In ordinary attacks you will find the urine very acid and not changing for days, even in hot weather. During the intermission it may be alkaline. On the paroxysms being interrupted, a copious sediment of urate of ammonia usually appears, and has for ages been spoken of as marking a favourable crisis. It has been shown that during the cold and hot stages there is a great increase in the amount of urea excreted; but on the sweating stage appearing this falls again, and often becomes less than normal.

Neuralgia, in its protean forms, is often the result of previous attacks of intermittent fever, or of a residence in a malarious district when a distinct attack of ague has not been produced. Such neuralgia usually observes its periodicity with the greatest regularity. Further, ague seems to have the power of impressing on other subsequent diseases no insignificant degree of its periodicity; so that any approach towards periodic recurrence of various symptoms leads us naturally to inquire if the patient has ever been in a malarious district.

Moreover the patient may have been free from ague for years, and yet without fresh exposure, a paroxysm may be excited by any depressing influence, as if his constitution had undergone some change which rendered him liable to suffer from ague whenever his health from any cause might be deteriorated. Gastro-intestinal derangements are specially likely to trouble those who have suffered from ague, and the hindrance to nutrition thus produced tends to waken the sleeping enemy. Thus a vicious circle is established from which it is not easy to escape.

Exciting Causes.—You see, then, that although the disease originates in malaria, you must not ignore secondary causes, which, in their turn may become the immediate or exciting cause of a paroxysm. Nay, more, the malarial poison may have effected a lodgment in the system but not set up active symptoms—may, so to say, be sleeping—when some external influence may suffice to rouse it into activity. Of these influences, perhaps, a **chill** is the most energetic; hence the confidence with which chill is sometimes alleged to be the sole efficient cause of malarial fevers. But chill will not alone suffice—nor will damp, nor exposure, nor all combined—or we should never be more free from these diseases in England than you are in Africa. Why should you have ague and I rheumatism, and a mutual friend, catarrh, through subjection to precisely the same exposure? And this question applies in thousands of cases extending over generations, and observed with the utmost care and desire to ascertain the truth.

You are, then, to avoid chills—that is, you are to avoid damp, cold, exposure, over-heating, and all the influences which, in England, you learned to regard as probable causes of colds, catarrhs, or rheumatisms. But there are other exciting causes to remember, and, in Africa, the first of these is **insolation**, a word which is used as the equivalent of sunstroke, heat-stroke. or thermic fever. In England this is rare, even in unusually hot summers, and we cannot bring ourselves to fear the sun as an enemy. With you it is different—you know his power and can understand the danger of braving it. But the constant presence of this danger may give rise to forgetfulness or carelessness. Especially is this so with those who have not had a long experience of the tropics. Hence your new recruits should be particularly urged to be careful in this matter. At the same time you may remember that it is not the sun only which is concerned in the production of **sun**-stroke, or, as it is often called, **heat**-stroke. This is shown by the unexpected fact that these attacks constantly occur under shelter and at night. Further, military records show that when men are marching in close column they fall in much greater numbers than when scattered in skirmishing order—that is, spread out over a large area. It is, therefore, clear that heat-stroke is not due merely to the sun.

There is another exciting cause to which similar remarks apply. I mean **fatigue.** Recruits full of zeal, anxious to accomplish some important object, may think they can safely do it by a spurt, and will over-exert themselves, in the expectation that a rest will as soon put them right as it has done before in England. Fatal error! When the time for rest comes, the mischief may have been done; instead of sweet sleep the reaction of febrile excitement may be felt; the poison lurking in the system has been roused into activity, and the work done has been achieved at the cost of a serious illness. As your own experience can scarcely fail to convince you of this, I will take the liberty of pushing it further. It is not always raw recruits who fall into this error. Even veterans have been known to allow their zeal to outrun their discretion; to forget, in their ardour, the necessary precautions; or perhaps over-estimating the importance of the goal, to deliberately run the risk of falling in the race.

Now, my dear friend, permit me to caution you, and ask you, in turn, to caution all your band. Be in this a faithful bishop over them. By precept and example—especially by example—impress upon them the absolute necessity of taking care of their health. It is not the duty of a missionary to court danger or seek death in the determination to attain some immediate object. That form of heroism has been sufficiently exemplified on other fields. It is, rather, patient endurance, perseverance in quiet waiting, that will conquer in the tropics; so be content to "cast your bread on the waters," to scatter your seed as opportunity offers, "here a little and there a little"; and may you be spared for long years of service, exemplifying in your own person the possibility of retaining fair health and accomplishing much work in an African climate.

A further exciting cause of an attack may be **deficient nutrition.** Whenever this exists, the system is more incapable of resisting disease. Thus you see how imperfect digestion may determine a paroxysm in one person, while another, exposed to the same influences, escapes because vigorous digestion has maintained his nutrition. And so it is in regard to every depressing influence Whatever debilitates may precipitate an attack. We see this in England in persons who have resided in the tropics. East winds, sudden changes of weather, exposure to damp or cold, draughts, disordered digestion, and other circumstances, bring on in such patients an attack of ague, or some other intermittent malady. In fact, old Indians, African travellers, and other sufferers from hot climates, appear to have undergone such a modification in their constitutions that any debilitating cause readily excites in them fresh manifestations of the malarial influence. How much more important, then, must it be to maintain nutrition and prevent debility in those who are still residing in such climates.

Treatment is preventive, palliative, or curative, and may be appropriate to the premonitory stage, the paroxysm, and the intermissions. As to prevention, the statements I have already made as to the nature and causes of the disease—predisposing and exciting—as well as the hygienic rules you are to follow, should suffice to suggest the most important points. Avoid chills, exposure to sun, well-known unhealthy districts, and all depressing influences. Live on wholesome food, be specially careful about your drinking water; take care of your digestion, do not over-fatigue yourself, and do not neglect any slight ailment by which you may be attacked, but cure it at once. This particularly applies to the alimentary system. In a word, maintain as fully as possible a high state of nutrition, and your power to resist disease will, like your muscular strength, be most vigorous.

It is also desirable at times to resort to the specific influence of quinine as a preventive. This brings us to medicinal treatment, which may be varied according to the period of the disease, and is usually divided into that appropriate to the paroxysm and the intervals. I will, however, premise a few words, for the special behoof of you missionaries, on the premonitory stage.

The idea of arresting a paroxysm after the accession of the cold stage is now generally abandoned. When once the cold stage is present the paroxysm will pass through the hot and sweating stages. But there are many cases in which the premonitory symptoms are definite, and the patient knows quite well what is impending. The question therefore arises—can the fever be cut short then? Mild cases certainly may. Anything which will induce a perspiration is likely to do so. A cup of hot tea (weak) or a good draught of any hot fluid—hot water is as good as any—will sometimes do this and so ward off the attack. Such simple means should not be neglected.

On the other hand, the notion of working off an attack is fraught with danger; for although exercise may be beneficial so far as perspiration is induced, the benefit is much more than neutralised by the fatigue or exhaustion which follows. The system is less fit to work than in full health; there is need for rest, not exercise. It is specially necessary to insist on this in persons situated as you are. You feel the indisposition, the *malaise*, which reminds you of former attacks, and this too often at a time which seems specially inconvenient to rest. You have heard men say they have thrown off an attack by force of will, by a good walk, or by turning to some active work which threw them into a violent perspiration. Here, moreover, is just the piece of work which seems urgently to need doing, and which could not fail to give you a good sweat. You are sorely tempted to try it; but I warn you not to yield. My prescription is to **go straight to bed**, take plenty of hot drinks, cover yourself well, and rest quietly.

The needed perspiration may come; so, too, may sleep, and you may wake refreshed and escape the threatened fit. Even if not, you are in better condition to endure it than if you had endeavoured to throw it off.

Now, as to more active treatment. Formerly, emetics were in great favour, but they have to a great extent been displaced by purgatives. If you select your cases, I think you should derive all the benefits attributed to them by former observers. If the stomach be full at the commencement of an attack, the nausea, vomiting, and other indications of gastric derangement are likely to be prominent. Why not, then, at once empty the stomach by a simple, or slightly stimulating, emetic? Tepid water (as much as can be swallowed) will suffice; if not, some salt or mustard may be added; or an emetic of sulphate of zinc (10 to 20 grs.), or of ipecac. powder (20 to 30 grs.) given. This brings on vomiting quickly, and, if the stomach be well emptied, a quantity of tepid water being drunk, it usually rests quietly for some time afterwards. Moreover, the emetic generally brings on a free perspiration, which is to be encouraged by warm covering and rest in bed: sleep often follows. Should the stomach contain rather indigestible food, or be overloaded, this treatment would be more distinctly called for. On the other hand, if the premonitory symptoms come on when the stomach is empty I should be disposed to omit the emetic.

In this case a purgative is more appropriate—castor oil is quick and mild in action, but some patients dislike it so much that it may provoke prolonged nausea. The best way to take it is in hot milk. Put the dose in a cup and stir in gradually milk or other bland fluid as hot as you can comfortably drink. A drop or two of essence of almonds or cinnamon, or any flavouring preferred by the patient, may be added. Sulphate of magnesia or of soda, or the two together, may be taken instead. The salts may be dissolved in hot water, and if sugar and some citric acid or lemon juice be added you have a hot aperient lemonade which will serve as the appropriate hot drink for the patient. If a still more active purgative be thought necessary, calomel and colocynth pills will be efficient, but they do not act so quickly. In fact several hours elapse before any evacuation is produced, but then it is very thorough. No doubt you are aware that Dr. Livingstone had great confidence in a cathartic containing calomel. His usual form was jalap resin and rhubarb, of each 6 or 8 grains; calomel and quinine, of each 4 grains. This is the proportion of " Livingstone's rousers," as they were called by his followers, and this dose was given to any one who became "lethargic," or had other premonitory symptoms. In about five hours copious dark evacuations followed. If not, a purgative enema was given to hasten the operation. For strong men there is no objection to this practice, backed up as it is by Livingstone's long and large experience. For weak persons, or those who have been debilitated by prior attacks, I should feel inclined to diminish the cathartic or to employ the milder ones already mentioned. Further, anyone who has ever suffered from **dysentery** or is **liable to diarrhœa** should **not** be subjected to such treatment. They might, however, take a dose of calomel and opium, followed by castor oil or a rhubarb draught.

Treatment in the Paroxysm.—The chief indication is to shorten its duration, but this is only to be done by hastening the access of the sweating stage. This is desirable, because during a severe cold stage internal congestions are produced, and the febrile heat of the hot stage tends to inflict serious injury on the viscera. In this country we adopt but simple measures, covering the patient with warm clothes, and perhaps putting hot bottles in his bed during the cold stage, so as to hasten the next: then on its appearance removing the extra coverings, taking care not to go to extremes or to expose to a chill. In a very severe case we might have to combat exhaustion or collapse towards the close of the hot stage by special treatment. The sweating is to be encouraged, but not unduly; warm diaphoretics and anti-spasmodics are often useful. In grave cases of a low type it is desirable to be a little more active. Keeping to the indication to **hurry on the late stage** we might resort to more powerful sudorifics; a warm bath, with friction of the limbs, or the vapour bath, which is a very potent agent, and used to be much relied on when ague of a malignant type was more common with us than now.

I gather from what you have told me that in Africa you meet with many mild attacks of fever, for which the treatment I have described would be ample; but there you also meet with malignant fevers calling for still more active measures. As you cannot easily decide at first what is the type of fever, you should treat every case **promptly**, but **not too** boldly. When from any cause nothing has been done until the cold stage has set in, push the treatment described as fit for the premonitory period. Rest in bed, warmth, friction of the limbs, warm drinks, diaphoretics. Emetic if indicated, if not, the cathartic as there stated.

It seems, too, that in Africa this cold stage is often very brief, and sometimes scarcely perceptible. Such cases are often, you say, severe. Well, even so, the principle of treatment remains the same, and I see you have acted on it hitherto. Hasten the perspiration. You have used hot drinks, dry packing, and diaphoretic medicines—chiefly opium. Good! Continue to follow what you have found so far useful. As I told you years ago, I have no fear of opium for this purpose, and I should prefer those diaphoretics which were not depressing. The depressing influence on the heart is an objection to jaborandi or pilocarpine, but if sure that this organ was sound, I might be tempted to try it. Perhaps you would do better with the vapour bath, which, in some regions, has been held to be the only thing worth using during the paroxysm. Or you might try the lamp bath* which you have often seen me resort to as a potent sudorific, and which is so easy to fit up and manage. It is true that some authorities object to the vapour bath as too severe, and class it with exhausting measures like violent exercise. In this country it may not be frequently called for, but in the severe fevers you meet with I cannot but think it might prove useful if tried early enough; and in the manner you have seen it used you know that it can hardly be called exhausting or debilitating. Certainly, if you induce the perspiration quickly you have gained a good deal. Hot fomentations are also useful, both as aids to the diaphoretics and to relieve pain. When there is much gastric distress, with pain at the pit of the stomach, hot fomentations or a mustard poultice, or, perhaps, better still, turpentine stupes, may be applied.

You will say most of the measures thus far enjoined seem most appropriate to the cold stage—that is, the earlier part of the paroxysm. True, and the earlier they are put in force the better, and that is the reason why I even spoke of some as suitable in the premonitory stage. Of course, the shorter the cold stage, the less time you have for carrying out this treatment, and as this cold stage is so often very short or almost absent in African fevers, there is the greater reason for promptitude in the use of means adapted for it or for the premonitory stage.

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* A chair or stool, under which a large oil or spirit lamp is placed. The patient to sit upon the chair with a pair of large blankets folded round him and the chair, so as to confine all the heat. The patient, of course, must be naked, and a towel or a pad of flannel will serve as a cushion and may be wrung out of hot water. This form of bath soon brings on copious perspiration. Afterwards a tepid sponge bath can be given, and the patient put to bed.—T. J. C.

Now, a word about the succeeding condition. When the cold gives place to the hot stage the treatment must be changed in a corresponding degree. The patient will now probably desire cold or even iced drinks, and throw off the extra coverings he was previously so glad of. This natural leading may be followed, the only precaution being to prevent chill. Cooling saline beverages, perhaps iced, more particularly when there is vomiting, are most grateful. If the heat of the surface is distressing, sponging with cold water or vinegar and water is very refreshing. When there is congestion of the brain, shown by severe headache or delirium, cold affusion or ice compresses to the head are called for. In ordinary agues these measures will suffice, but in pernicious fevers, when the temperature runs high, cold baths should be tried.

You seem to have used cold packs which, in moderate cases, should be useful; but will not suffice for the reduction of very high temperature. Opium may be used in the way you direct. Dover's powder or laudanum are perhaps the best preparations. Spirits of nitre and sal volatile (half a dram of each in water) may be taken from time to time as a diaphoretic draught if the stomach is not too disturbed, in which case morphia hypodermically should replace the Dover's powder, and iced drinks be given. If the stomach has been troublesome up to this time, and no emetic has been given, it will be well to try one at once, and follow up with turpentine stupes or a mustard poultice. Continued vomiting may also call for other anodynes (prussic acid, &c.), but the morphia injection will often check it.

When the sweating stage comes on let the patient lie quietly in bed until it is over. On the morrow, if the temperature has fallen, let him get up, taking care not to get a chill, and rest a few hours, properly covered, on the outside of his bed or on a couch. If the temperature continue above normal he must keep in bed, though his linen should be changed. A few hours after leaving his bed the patient may, if disposed, go into the open air, provided the weather be suitable, and he be properly clad. He should remember he is now very prone to catch a chill, and should therefore be careful not to expose himself to that danger, or to fatigue himself.

Quinine.—You wonder I have said so little of the great antidote to malarial poison. I do not undervalue it, and, as you see, would give it with the purgative, as in Livingstone pills—but in this way it has only a certain value, and I wished to give a whole paragraph to it.

Quinine is usually regarded as only appropriate during the intermissions. Some are content to give 3 or 4 grains every four or six hours, suspending it during the paroxysms. Livingstone gave three doses of 4 grains each after purgation, others give 5 grains three times a day throughout the interval, and one dose of 20 grains a couple of hours before an attack is expected. Others prefer a single larger dose, 15, 20, or 30 grains in the interval. Some give even more. Piorry gave 50 grains, which cut short the disease and produced considerable reduction in an enlarged spleen. These massive doses, however, are sometimes attended by much inconvenience and suffering, or even danger, and are therefore not called for in ordinary cases of intermittent fever, especially in those not habituated to the remedy. From 5 to 10 grains towards the close of the paroxysm, and a similar or a smaller dose five or six hours later, will suffice for a mild case. More severe ones may require 20 grains, and then, perhaps, it is best in a single dose. If the disease is arrested the remedy should still be continued for two or three days, one dose of 5 or 6 grains, or perhaps better, two doses of 2½ or 3 grains being taken daily.

The points between several small and one or two large doses may be briefly stated, thus:—With small doses it is easy to occupy the entire period of the intermission without bringing the system thoroughly under the influence of the remedy. Then small doses often suffice to make the paroxysms milder, but do not arrest them. Of course, the longer the interval the more time is given for the small doses—that is, more doses are given. But with short intervals, very few can be given. Most of those who adhere to divided doses give larger ones just before the expected attack—an approach, at any rate, to the other method. The amount in the single dose method is to be measured by the gravity of the case. This plan has the advantage of promptitude—it brings the patient at once under the influence of the remedy, and often entirely arrests the paroxysms. The stomach will often retain a single large dose when frequent repetition leads to disgust. The single dose can be taken in wafer paper, and so not be tasted; but small ones should be taken in water to secure rapid absorption, and therefore many patients prefer the one massive dose. The one dose does not so much interfere with taking food. When the stomach is irritable, opium can be added with advantage to the large dose, but does not need repetition. Aromatics may also be used at the same time. When the stomach cannot tolerate quinine it should be given by the bowel, and in such case the single dose is obviously advantageous. Here, too, opium should be added, and the quantity of the enema should be small, or it may not be retained.

Quinine may have to be given hypodermically. It acts more rapidly when thus introduced, and only about a third as much need be given for a dose. For this purpose you should use the bi-sulphate, which is soluble in water without additional acid. A free acid is irritating, and the injection of it may be followed by abscess. It is said that in India tetanus has followed such injections. I don't know if you see tetanus on the Congo, but it is desirable to avoid any risk, and the abscesses are bad enough to make you shun an irritant injection. Hydrochlorate of quinine is also a comparatively soluble salt, and containing rather more of the alkaloid, the dose is somewhat less, say seven grains may replace eight.

It is usual to give the quinine only in the interval—and your own practice has been to wait until the temperature falls to 100° Fahr. before administering any. This may be a good rule in mild intermittent, but I should not apply it in severe and dangerous cases of malarial fevers. In such cases there is need of prompt action, and the interval is often short. I should therefore advise you not to wait. In defence of this view I submit that the full effect of a dose of quinine is not attained as soon as it is swallowed. It takes several hours before the maximum effect is attained. We know that a massive dose will greatly reduce feverish temperatures—the greatest fall being from five to ten hours after the dose. Now, as this reduction is probably closely related to its other effects, why not aim at making it coincide with the natural fall in the sweating stage? It has been found in typhoid and other diseases that a large dose so timed has been much more potent as an antipyretic, and I think you should, at any rate in grave cases, not wait for the fall before giving it. You might try whether moderate doses so timed are not more effectual in mild cases of intermittent, and, if so, that would give you confidence in the more dangerous Congo fevers.

Continue the quinine every day until the paroxysms are arrested. On no account be tempted to suspend it in favour of any treatment for intercurrent maladies. Cut short the intermittent and then will be time enough to attend to complications. As long as there is a rise in the temperature at the time of the expected fit, go on with quinine; moreover three or four weeks after convalescence the patient should again be subjected to quinism for a few days, besides the preventive use already spoken of.

Warburg's Tincture, you inquire about, is a combination of quinine with aromatics, and it is said by competent observers to be powerfully sudorific, and for this reason not desirable in low cases, as the excessive sweating produced is too depressing. I can hardly endorse this. Sweating is not so exhausting as some people think, and when excessive can be restrained.

Arsenic has been found of great value in intermittents, and a liquid something like Fowler's solution was once known as "tasteless ague drops." It ranks next to quinine as an antiperiodic, but it is not adapted for acute cases or fresh attacks. Reserve it for intractable cases of long standing, for the neuralgias and other affections that result from malaria, rather than for the distinct fresh attacks of ague. In malarial cachexia, too, it is invaluable, and iron can be given at the same time. Often good will result in a few days, but generally it will require two or three weeks to make much impression. In all chronic cases then, especially if refractory to quinine, try arsenic, Fowler's solution, or the hydrochloric solution, and if the patient seem anæmic give iron at the same time. As to other medicines, there is little to be said for them for your special purposes. As to substitutes for quinine, I advise you not to trust them. Be content to get perfect in the use of one tool at a time, especially when so useful as this. Leave Europeans to experiment and add to our list of antiperiodics. Missionaries may well be satisfied to profit by what is thoroughly established. Eucalyptus globulus has been much praised, and the oil, tincture, or extract are sometimes given. But you should hardly trust them, unless as preventives when you are suspending quinine for a time.

Antipyrin, about which you ask, and allied substances, no doubt, will be found useful to us. They are distinct antipyretics—that is, they reduce febrile temperatures. But quinine will do this and something more. Quinine is an antidote to malaria, and it has not been proved that the new antipyretics possess this important power. This last remark does not apply to the other cinchona alkaloids; but even they are inferior in several respects, and, therefore, I do not recommend you to resort to any substitute for quinine.

LETTER XIX.

REMITTENT FEVER.

My dear Friend,—

In this you have a more dangerous malarial fever than intermittent. You may, if you like, regard it simply as a more severe disease of the same character, due to a more intense degree of malarial poisoning, or to unusual susceptibility on the part of the patient. Intermittent may pass into a remittent, or even into a continued form, either through the long duration of the paroxysms, their too early recurrence, or the brevity and incompleteness of the interval. Again, the co-existence of other febrile or inflammatory diseases may obscure the distinction.

In remittent fever you have no complete intermissions, only more or less distinct **remissions** and **exacerbations.** The stages seem to run into each other. Very likely there is no cold stage, though a certain chilliness may be felt. The hot stage at once comes on, and is very intense. Vomiting is often a prominent symptom, occurring every few minutes, being excited by the least movement, and accompanied with violent and painful retching. At first the contents of the stomach are brought up, then more or less changed biliary matter, so that you will have yellow, greenish, brown, and even black vomit. A yellowish tinge of the skin is generally observed, and this often deepens into distinct and severe jaundice. The liver and spleen are enlarged and tender. In other cases head symptoms are most prominent; intense headache, restlessness and giddiness, passing into **delirium**, often of a mild form, mere "wandering," but sometimes violent. Or, instead of delirium, the patient may pass into deep **coma**, from which he may not again return to consciousness; though even from this grave state recovery may take place.

After a variable period, corresponding in some degree with the gravity of the case, there is an abatement of the symptoms—the remission. It may appear in six or eight hours—more frequently not for twelve or twenty-four, sometimes not for thirty-six or forty-eight.

The disease observes a sort of diurnal regularity, thus a morning remission may usually be observed. The exacerbation which succeeds and is usually more intense than its predecessor will perhaps begin about midday and last to midnight when it abates. Or if it begins at midnight it will last till morning. In some cases you may get two distinct remissions and exacerbations in twenty-four hours. Usually the recurrence is daily, resembling a quotidian, but sometimes it may be rather like a tertian, and sometimes may be only detected by careful observations with the thermometer.

The **temperature** rises from the beginning. In severe cases the height and rapidity of the rise correspond with the degree of danger. The maximum may be reached early—even in the chill, when there is one—and the thermometer may remain at this point for one, two, or three days—a very grave sign. Then in favourable cases there is a gradual fall, and morning remissions and evening exacerbations are established. In the remissions the temperature does not fall to normal, perhaps only to 103° Fahr., or 102° Fahr., or 101°. In the exacerbation it will rise again to 104°, 105°, or 107°, or even higher. The more rapid the rise and of course the higher it reaches the greater the danger.

The disease lasts on the average from five to fourteen days. Recovery often sets in with a free perspiration, appearing suddenly or coming on gradually; but sometimes the fever passes into the intermittent form.

Remittent fevers have been thrown into three groups, according to the severity of the cases. The chief use of such distinctions is to show the varying degree of intensity that may be presented by the disease. As intermittent may pass into remittent and *vice versâ*, you will not be surprised that different cases of remittent present very different pictures.

The mildest forms are the gastric or bilious remittents, which are met with in hot summers in the temperate zone. The attack may begin suddenly with a chill or may be preceded by derangement of the stomach or bowels.

Jaundice and diarrhœa are common, with tenderness over the spleen, and perhaps bleeding of the nose or other complication. The disease lasts from three to ten days, but sometimes drags on for weeks with pretty regular exacerbations often preceded by chills and tolerably distinct remissions accompanied by perspirations and sometimes subsiding into complete intermissions.

The severer degree approaches more to a continued fever. The remissions are much less marked, especially at the beginning. There may indeed be only here and there a distinct remission, and in some cases you may not detect this. These cases may begin with chill, and, at first, wear a sthenic aspect; but they soon assume the asthenic type—debility, ending in exhaustion, being the marked feature. Moreover, not only are the cases grave from the severity of the disease, but they often present dangerous complications, such as serious nervous symptoms, delirium, or coma; paralytic or convulsive attacks; inflammation of the spleen, lungs, parotid glands, &c.; diarrhœa or dysentery. Any of these, of course, add to the gravity of the case.

The third group comprises the most fatal cases. From the beginning they are distinctly asthenic, and extreme prostration sets in early. The patient is often melancholy or apathetic, as if the depressing influence of the poison or its intensity had overwhelmed him; but, perhaps an unfavourable constitution or other external conditions may determine the severity of the attack. Sometimes the disease comes on without any specially alarming symptoms, beginning as a mild fever; but soon the remissions and exacerbations are found to be indistinct and irregular, while extreme debility is manifest. In other cases, the disease sets in with severity, a chill or rigor being quickly followed by the febrile heat, and this, in a few hours, by exhaustion.

In whichever way the onset occurs, though the patients first complain of pains in the extremities, joints, or back, they soon cease to do so, and it is obvious they are too ill to be troubled by such pains. The nervous system has lost its sensitiveness, the sight is dim, hearing dull, feeling obtunded. The mental power is lessened, there is apathy to all around, or perhaps drowsiness which may pass into coma; but, in other cases, there is extreme restlessness and excitement passing into delirium.

The pulse, even if full at the onset, soon becomes small as well as rapid, ranging from 100 to 140, and getting more rapid, but weaker, as the disease proceeds. In many cases there is also frequent vomiting and retching, which contributes to the debility and hastens the termination in exhaustion. At the same time the thermometer marks a very high temperature—hyperpyrexia, as we say, sets in—but in other cases debility is extreme, the temperature may even fall below the normal, while obviously the patient is no better, but rather worse. This is a mark of extreme asthenia.

LETTER XX.

TREATMENT OF REMITTENTS.

My dear Friend,—

If you regard remittents as aggravated intermittents, just as the most aggravated remittents seem to become continued fevers, you will see that the principles of treatment in all these malarial fevers must be the same, the details being modified by the nature of the cases. Quinine, then, is the antidote—the sheet anchor on which you depend; but the difficulty sometimes is to get it into the system, and the other measures must not be omitted, though they will have to be modified.

At the outset an emetic may be called for. You seem always to have found this beneficial. If the stomach were empty and not irritable I should rather omit it, but if loaded it would be as well to empty it, and even when vomiting comes on early, as it too often does, there could be no harm in washing out the stomach by giving a large draught of luke-warm water, as much as the patient can manage to swallow. Carbonate of soda (30 grains) may be dissolved in the water with advantage. It neutralises acidity, and helps to calm the stomach. If the bowels are not free, a purgative early, containing calomel. Livingstone's pill, if taken early enough ; but it is severe in adynamic cases, and I would rather give simply a dose of calomel, or calomel with opium, as previously stated, quinine being added to the pill, or taken at the same time. If the stomach be irritable, or the patient have a tendency to diarrhœa, you may give 5 grains calomel, and one of opium, with five of quinine.

To restrain the vomiting when distressing, iced drinks may be given, or small lumps of ice sucked from time to time. Effervescing draughts are also recommended. A mustard poultice or any counter-irritant over the pit of the stomach will often arrest the vomiting. Turpentine sprinkled on flannel (and covered with oiled silk or another flannel) is an excellent and cleanly counter-irritant.

For the brain symptoms ices or cold affusions to the head are recommended with counter-irritation to the calves. But quinine must be given even in coma and it may be combined with opium in extreme restlessness or delirium.

If head symptoms—coma or delirium—persist, you may apply a blister at the back of the neck and cold affusions to the head. If the extremities become cold, frictions, hot bottles &c., are called for. If the whole surface becomes cold a number of hot bottles, hot bricks, &c., may be put in the bed to keep up the warmth. Ammonia, ether, and other stimulants are also called for. Equal parts of aromatic spirits of ammonia and spirits of chloroform, make an agreeable medicine, which is soothing to the stomach. A teaspoonful of this in water may be taken for a dose and repeated at frequent intervals. Other nervine stimulants or antispasmodics are sometimes preferred, especially ether.

Some also recommend champagne or hot spirits and water in these desperate cases. But remember they are only of use to tide over the immediate danger, to rouse the heart and keep up the circulation until other measures have time to act.

Quinine must be given at least to the extent of marked cinchonism—30 to 50 grains a day may be required. The question is how to get it in, and whether to divide the dose. As to introducing it, if rejected by the stomach, it can be given by enema, in which case larger quantities will be needed. If this fail, or time press, the hypodermic syringe may be called in. The dose then may be proportionately less. It is often advised to wait for the remission, and then give 15 or 20 grains of quinine every two hours while it lasts. But how if the remission does not come? and I have mentioned that in some malignant cases you may detect none. I answer, do not wait. If a remission be due, you may, if you like, begin at that time. I should not hesitate to begin before an expected remission, so as to make the antipyretic effect of the dose coincide with the expected fall of temperature. Try this method; and, further, if you can detect no appreciable remission, give quinine. It is the antidote, and must be given. I cannot see why people hesitate. As to single large, or successive smaller doses, it is not of such consequence. The large dose, if retained, has not to be repeated so often. This is a comfort to the patient, just as the repetition of small doses may be a source of discomfort, and may interfere more with other measures. In either case push the drug to full quinism, and keep it up.

Baths.—It seems that in the majority of cases, as you describe them, instead of the exhaustion, you have a persistent high temperature. There is either no remission or a very slight one. Now it is in such cases I recommend you to begin the cold bath treatment. We say cold, but tepid would more nearly describe them. Full length baths, between 68 and 78 are included in this antipyretic method. You may try them therefore at the ordinary temperature of the water you can get on the Congo, and you will, perhaps, soon be glad to cool the water with ice. The object of this plan is simply the abstraction of heat. When the temperature is persistently excessive it is in itself a source of great danger. The heat alone is lethal, and it gives rise to degeneration in the tissues of the organs. The indication then is to reduce the temperature, and the quickest and most certain way of accomplishing this is to put the patient in a cold bath. You place him thereby in a colder medium which readily abstracts the excessive heat. Instead, therefore, of the cautious tepid sponging you have used and with some effect, try the baths. They are much more powerful. With a persistent temperature of

103° Fahr. in the axilla you may begin the baths, and the call for them increases as the temperature rises. The patient is to be placed in the bath so that only his head remains out of the water and that should be wetted, and, if the head symptoms are marked, affusions at the same time used. He need only remain in the bath eight or ten minutes—he is then to be taken out, wrapped in a dry sheet, and put to bed. The feet may be wrapped in a warm towel or you may warm the whole sheet in the sun.

The bath abstracts a good deal of heat. You may find that the thermometer is not so much reduced as you expect immediately after it. In the interior of the body (as rectum) it has not perhaps fallen. Do not be discouraged. It is not until some time afterwards that the full effect is produced. The temperature will continue to fall after the bath; but this will cease, and it will begin again to rise. What then? Repeat the bath. Repeat it as often as the increase of the temperature demands. In mild cases of fever the reduction obtained by a bath has lasted several hours. In severe cases the temperature has risen again within two hours to the point it had reached before the bath. These baths every two hours, night and day, have undoubtedly saved many lives. Usually from four to eight baths a-day have sufficed. But when you institute this treatment in any case, make up your mind that a single bath may be of little, if any, service. Keep the bath ready filled in the room and then all is ready when the febrile heat returns to again abstract it.

The cold often seems disagreeable to the patient, and some have therefore given the baths at a somewhat higher temperature, keeping the patient in them proportionately longer, and cooling them gradually by adding colder water or ice. The effect is not so marked. Perhaps your best way will be to use the water as cold as you find it on the Congo.

If you feel any hesitation when the temperature is not very high, you can have none in hyperpyrexia; for there is no other treatment worth your attention. By hyperpyrexia in this country we usually mean a temperature of 107° Fahr. or upwards, which point has been rapidly reached, with a tendency to rise further, with grave nervous symptoms or indications of complications. We meet hyperpyrexia most frequently in acute rheumatism and heat-stroke, but it comes on in other febrile states.

You will observe that it is a persistent high temperature—little or no remission—that is the indication. Of course, in simple intermittent the temperature may run quite as high, but then you get a complete intermission, in which it falls again to normal. You have an interval of apyrexia. Such cases quinine can control and cure, therefore you need not resort to the baths. But in the remittents you have encountered on the Congo the temperature has been high, and remained so, with slight remissions only. In all such cases I would have you employ the baths to bring down the temperature. They will not remove the malarial poison; you must trust quinine to do that. The object of the baths is simply to control the temperature. By them you may at least be able to secure a marked remission, which is so much gain, and perhaps you may reduce the course of the remittent to that of an intermittent. Aim at this. Give the first bath at the time of the anticipated remission, or if no abatement of heat has been noticed, give it in the morning, which is the time of the natural fall of temperature. When the effort at reduction coincides with a natural falling wave, it is more effectual. This applies also to quinine, and is the reason why I incline to single massive doses. By a large dose in advance of the expected fall we get the full antipyretic effect of the drug to coincide with, and so reinforce, the natural downward curve. You will then try to time your remedies in this way, and when there is no remission to be counted on you will still reinforce the baths by the quinine, regarding the latter not only as antipyretic but as antidotal.

You see I do not trouble you with theories of the origin of the heat or the action of antipyretics. You can look them up if you like in the book I gave you. I only want to impress on you that you have to deal with excessive heat, and that you can abstract this by cold water. This is a remedy which your missionary band may learn to apply with effect. The clinical thermometer will be your guide, the temperature being taken every two hours or so. This bath treatment may be safer in unskilled hands than the full use of powerful drugs. At the same time, quinine must not be neglected. It helps in the reduction of temperature, but is still further useful: it is antidotal, and so curative.

In case of a tendency to faintness, stimulants are advised either before or during the bath. If the heart's action be weak, it may be advisable to give a dose just before the bath—spirits of ammonia or ether. Some would prefer alcohol. Three tablespoonfuls of sound claret a few minutes before the bath, and, if required, another spoonful while in the bath or after it. If any stronger wines or spirits are at hand, the doses should be proportionately less. The propriety of repetition must be decided by the pulse.

Before dismissing cold water, I may mention that locally it has been found of service in the enlargement of the spleen and liver brought about by malarial fevers. Some only use cold or iced compresses, but affusions from a considerable height, or douches projected forcibly on the swollen region, seem more effectual.

LETTER XXI.

SOME VARIETIES OF MALARIAL FEVERS—PERNICIOUS FEVERS.

My dear Friend,—

Many deviations from the ordinary course of malarial fevers are met with, and have received names more or less appropriate. Some of them are characterised by complications by which they are grouped. These and other cases of a dangerous kind, whether the danger arise from the constitution of the patient or from local disease in an important organ, are spoken of as malignant or pernicious fevers. Thus, we have the comatose variety, in which drowsiness and apathy are early symptoms, and the patient falls, perhaps in the first hot access, into unconsciousness, lasting until the sweat sets in, and sometimes extending over days. Cold affusions to the head, a blister to the nape, quinine by enema or hypodermic injection, are the most likely to afford relief. If the temperature be very high, the baths may be used to bring it down. If, on the contrary, you see indications of prostration and heart failure, give a stimulant enema or hypodermic injection of ether.

In another group of cases, fainting is the prominent danger. Coming on in the cold stage, a succession of fainting fits, with a small but frequent pulse, may be followed by a brief hot stage of moderate intensity.

Here obviously the stimulating treatment is appropriate. The patient must on no account be even partially raised from the recumbent posture. Ether subcutaneously or stimulating enemata, should be given. In the latter, turpentine does well as a stimulant, but need not be given so strong as in the pharmacopœial enema of turpentine, and can then be repeated. A teaspoonful well beaten up with the yolk of an egg and a little barley water or gruel may be retained, and will be both stimulant and nutrient. So other nutritious material can be introduced in this way with the stimulants, and quinine also.

In some cases patients have sunk into a trancelike state which has simulated death, but have yet recovered. Similar treatment is indicated.

On the other hand, you may have cases marked from the first by cerebral excitement speedily passing into delirium. Here opium, morphia, or chloral or bromides should be added to the quinine treatment. In a favourable case, the delirium grows milder, perspiration ensues, and the patient may fall asleep.

Convulsive and spasmodic affections sometimes mark the cases, showing that the spinal cord is suffering as well as the brain. They have received various names. All such complications are grave.

Choleraic and algid malarious fevers have been described as occurring in hot countries, and would call for modification in the treatment—that is, for the employment of remedies directed towards the choleraic discharges, or the algid state, which is marked by stony coldness of the surface and subnormal temperature, sometimes only 84° to 88° Fahr. Frictions are called for, hot bottles or hot flannels to the surface—every effort should be made to restore the temperature ; and the stimulating plan described above should be carried out. If recovery occur the patient will pass through a febrile reaction as in cholera ; but these cases are very fatal. Dysentery, hæmorrhage from the stomach or bowels and other complications may also occur, and render the case truly "pernicious."

Icteric is the name applied when jaundice complicates the case. This often begins with a long chill, during which the skin acquires a tinge of yellow, which may deepen to olive; bilious vomiting and diarrhœa follow, with urgent thirst, headache, and pain over the liver and spleen. The urine is deeply coloured, perhaps like claret or even porter, and stains the linen. The stain is from biliary colouring matter, not blood. Death may occur in the hot stage. If the patient survive, the perspiration stains the linen yellow. During the intermission, though the jaundice continues, the urine may return to a natural colour. If the intermission is not complete, the danger is greater, and the patient seldom survives a third paroxysm ; but if there is complete intermission, with active treatment, recovery may take place. Full doses of calomel (5 to 10 grains) are usually advised, in addition to quinine and the other appropriate remedies. I notice you have recommended a drink of cream of tartar with a little lemon juice. This is an excellent thing to quench the raging thirst, and tends to promote the action of the calomel.

The foregoing complications may attend intermittents, rendering them "pernicious." So they may occur in remittents, as may other complications. The most important of the latter is that about which you particularly ask, viz.:—

Hæmaturia.—This is always dangerous. Other hæmorrhages often accompany it. The disease is only found in intensely malarious districts, and some think it occupies a sort of middle ground between malarial and yellow fevers. Perhaps some cases of the icteric form have been mistaken for this. The distinction is that here there is blood in the urine. The fever may begin as an intermittent, but soon becomes remittent, and even continued. Vomiting and purging of biliary matters come on, though at first there may have been constipation. An icteric tint of the skin is present, but not very deep, and though the urine resembles that of the icteric form, the colour is due to blood, not bile. It is desirable you should distinguish these two forms. The spleen and liver enlarge, the pulse grows smaller and quicker, from 80 to 130, cold sweats break out, and coma comes on, perhaps as early as the second day. The urine diminishes in quantity, is sometimes suppressed. Hæmorrhages from the nose or other parts may break out, and purpurous bruises appear on the skin. The prognosis in these cases is most grave; but hope must still be entertained, as recoveries have taken place. The stimulating nutrient enemata with turpentine, will be appropriate, with quinine. Astringents are sometimes recommended, as gallic acid* with Dover's powder. You may remember that turpentine in small doses has been found very useful in hæmorrhages of various kinds.

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* We have often found gallic acid restore the urine to its normal colour. It may be given thus :—Acid gallic, grs. 15 ; Pulv. Doveri, grs. 10.—T, J. C.

LETTER XXII.

SEQUELS OF MALARIAL INFECTION.

* * *

Relapses are liable to occur in all forms of malarial fevers, and the type in the relapses may be changed. They are so apt to take place on the days on which the fever would have returned, had it not been arrested, that some would not call them true relapses; but they occur after the patient has seemed cured, and has been removed to a healthy place. They are to be suppressed by the same treatment as the first attack.

Kidney disease—diffuse nephritis, enlarged kidney, amyloid degeneration—sometimes seems to be set up by malarial fever. Albuminuria may arise from disturbance of the circulation during the fever, just as hæmaturia does; but later on, if abundant and constant, is probably due to disease of the kidney—enlargement or amyloid degeneration.

Dropsy, with or without nephritis, may be set up. It may also occur when the malarial poison has affected the system, but has not produced distinct attacks of fever.

Disorders of the stomach and bowels are often the result of the poison, or follow malarial fevers. Indigestion of various degrees, attacks of vomiting, hæmorrhages from stomach and bowels, constipation, diarrhœa or dysenteric attacks, especially with variable febrile symptoms, often seem to originate in malarial poisoning.

Enlargement of the **spleen** (ague-cake) and of the **liver** are also important sequelæ.

Malarial cachexia may not only follow repeated fevers, but is sometimes developed without any such attack preceding. A condition of ill-health, without very definite symptoms, or only such as are referred to other causes, is gradually established. The patient feels unequal to his work, has various complaints to make, loses colour, becomes pale, sallow, yellowish. There is often tenderness over the spleen, which, on careful palpation, is found rather large. A slight elevation of temperature may be detected. The pulse may be normal or rather frequent, or, on the contrary, less frequent than before. This degree of cachexia will disappear under change of air and quinine.

But sometimes a much graver cachexia is produced, in which the liver or spleen are greatly enlarged, œdema or ascites comes on, hæmorrhages recur, and the gums appear scorbutic. These and various complications, unless checked, lead on to extreme debility and exhaustion.

The treatment is to be varied according to the condition. Disturbances of the bowels and stomach should be allayed by careful diet and the appropriate medicines.

Acute dropsy and albuminuria often subside under quinine and iron. If the dropsy is considerable, diuretics may be given. Enlarged spleen and liver require quinine as long as the temperature is high, and afterwards iron should be added as anæmia is usually present. Besides this, cool baths, cold compresses, or better still affusions or douches should be employed.

In chronic malarial cachexia, quinine should be followed by a course of iron or arsenic, and baths or douches. In severe cases removal from the district must be enjoined. In all these affections it is necessary to keep up the nutrition as fully as possible.

Masked malarial fever is a term sometimes applied to cases which appear to originate in the poison but in which the symptoms are more or less masked. Neuralgias and other nervous diseases observing a more or less periodic type, or recurring again and again in persons who have been exposed to malaria, are the most common examples; but a number of other affections may also be traced to the same cause. In fact the malarial poison impresses such an influence on the patient that all his subsequent maladies may be thereby modified. Many of these so-called masked fevers yield readily to quinine, and do not lead to cachexia; others require arsenic. Diseases which seem to have been modified by malaria, and resist ordinary treatment, often yield when quinine is superadded; but chronic cases may need a course of arsenic, which should be combined with iron if anæmia is a prominent symptom.

LETTER XXIII.

FOOD IN FEVERS.

* * *

You say you take no food until the fever subsides, even if it should be thirty-six or forty-eight hours, and add that "a patient in African fevers can well go forty-eight hours without food." Others have said the same, and perhaps it is true in simple intermittents, as during the complete interval this loss may be made up; but forty-eight hours is a long time, and perhaps the modern doctrine of feeding fevers might be allowed a trial, so far as giving milk, if procurable, or gruel, and if this cannot be digested, peptonising it.

In remittents the tendency to exhaustion seems to preclude the starving plan, and I should, therefore, certainly advise that an attempt be made to maintain the nutrition. Milk, if procurable; if not, gruel, arrow-root, or other of the starchy foods, could often be taken, especially if pre-digested by pancreatic preparations.

Beef-tea with you may mean only extract of beef, which is no representative of the meat. Some other preparations, more or less peptonised, have been introduced, but freshly made chicken broth or mutton broth (and you have fowls and goats in Congo) would be much better. With an irritable stomach you will be giving ice, and it is as easy to sip iced milk, or even iced broth, as iced water. When only a teaspoonful at a time is sipped, being taken very frequently to assuage the thirst, a considerable amount of milk, or broth, or gruel is thus absorbed in the twenty-four hours; and if it can be taken it should be, in the night as well as day.

When food is totally rejected by the stomach, of course medicine will be. Then feed by the bowel. The enema syringe at every station should be always kept in good working order. In feeding by this method, food and physic can be given at the same time. Care in introducing the pipe will prevent injury. Only a small bulk should be thrown in at a time, or it is apt to be returned—not more than 4 oz.—and if that should not be retained, a less quantity. All food given by the bowel should be peptonised. You may begin with gruel, broths, or milk; then an egg may be beaten up in these. Later you may be glad to use fowl, kid, rabbit, or anything of the meat kind, chopped up, beaten in a mortar to a paste, mixed with a little hot water to bring it to the consistence of cream, and then stewed a few minutes. When cooled to 140° add some pancreatic solution, and let it stand in a warm place for a couple of hours. You can then mix it with quinine and whatever else is desired, and inject. Or you may use fresh sweet-bread, raw, 2 oz., with cooked chicken or kid 5 oz., well beaten together and worked up into a thickish creamy liquid, with enough luke-warm (not hot) water, milk, or gruel. Fat may sometimes be added with advantage. The enema should be given at a temperature of 90° to 96° F., and not be repeated oftener than twice in the twenty-four hours. Eggs and brandy are often given in enemata. I have already mentioned other substances as suitable for feeding by the bowel when stimulants, &c., are urgently needed. Of course this mode of feeding is inferior to the natural one, and as soon as the stomach can take even minute quantities, it is better to give them.

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LETTER XXIV.

PREVENTION.

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The statements I have already made furnish you with many suggestions as to prevention. In addition, I may say that quinine may be taken for this purpose. Two modes of taking it are recommended, viz., a daily or weekly dose. Small daily doses of 1½ or 2 grains have been used with some effect, but this seems not enough. Repeated twice a day, or three times, it greatly diminished the number of attacks, and rendered them very mild. Others recommend 4 or 5 grains night and morning while in a malarious district. But the system seems to become so habituated to the drug, that it is necessary to intermit its use for two or three weeks at a time. Other observers advise a dose of 12 grains weekly. It seems natural to suppose that the suitable amount would vary in different persons, and that it would only be necessary to keep up the slightest degree of cinchonism. In some, this would be attained by 3 grains a day, in others, much more would be necessary.

Your new recruits should be careful of their health throughout their voyage, so as to reach Africa in perfect condition. If arrangements could be made for you to spend some days on the vessel before landing, so much the better. I would not recommend you to land at any of the places on the coast at which your vessel may touch. There is no advantage to be gained, and you might only contract a coast fever, and so diminish the good effect of the voyage. Your trip at sea should be a holiday in which to recruit your health, and ought not to be abridged. This applies to veterans as well as new recruits. The latter, not knowing the language or habits of the people, can neither learn anything nor teach anything. The former have, perhaps, been working, as you have, before sailing, and the voyage is none too long to rest. Veterans returning after a stay in Europe should consider themselves as recruits, for there is reason to think that any degree of acclimatisation they have acquired may have been lost with the renewal of their health.

On arrival do not linger on the coast, but let each man go quickly and steadily to his station, taking the journey in easy stages and observing the precautions I have laid down for your guidance. On this journey—in hammocks, if possible—take quinine, especially in dangerous parts. Indeed, you had better begin quinine two or three days before landing—5 grains at bed-time, or, perhaps, those not accustomed to it, should take 2½ or 3 grains night and morning. If no slight degree of singing in the ears be produced, double the dose, and keep up this slight degree of cinchonism for two or three weeks, according to position, increasing the quinine in particularly dangerous spots. Intermit it in places you have ascertained to be tolerably safe. When omitting quinine, a little eucalyptus might be taken.

But warn your recruits not to trust to the medicine only, but to avoid unnecessary exposure, over-fatigue, and the other dangers I have pointed out; to be very careful as to clothing, especially as to the head covering; to avoid chill or "catching cold"; to live well, that is, on as good nutritious food as they can; to take care of the digestive system, endeavouring to maintain it in health; not to neglect either constipation or relaxation of the bowels—avoiding Scylla and Charybdis alike—at the same time, not to treat either so actively as to produce irritation; and not to lose their sleep or indulge in worry, but dismissing "carking care," cultivate a cheerful, contented frame of mind; then, if after all they should get ill, to go straight to bed and take quinine.

LETTER XXV.

MR. STANLEY'S VIEWS.

My dear Comber,—

Since I wrote to you Stanley's new work* has appeared, and no doubt you have already seen it. I have read with interest his remarks on Climate (chaps. 36 and 37, vol. ii.), and as you will be sure to speak of them at our next interview, I may as well anticipate your questions. First of all, I may say that, although I cannot altogether accept his views, all your colleagues should take to heart his warnings. He seems to have satisfied himself that a chill is the one sufficient cause of fever, and is disposed to treat the existence of malaria as a fable only worthy of ridicule. This is rather unfortunate, for it tends to weaken the force of his warnings as to the danger of chill.

This chill theory is not new, and as I mentioned in a former letter: Dr. Oldham† long ago summed up all that could be said in its favour. You will remember that I placed chill first among the exciting or immediate causes of paludal fevers, and that is its rightful place; but it is not alone capable of producing them, or they would devastate the whole earth, instead of confining their ravages to particular localities. I can sympathise with Mr. Stanley's love of Africa, and his indignation at exaggerated accounts of the danger of its climate. But that is no reason for shutting our eyes to the existence of malaria: Our love of England would scarcely justify us in describing its climate as sunny and equable, or its November sky as invariably bright. You might as well say there are no venomous insects or beasts of prey in Africa as deny that some parts are the abode of malaria. All recent advances in science tend to confirm the important part played by malaria, without which you would not have paroxysmal fevers. Nevertheless, chill is so constant an exciting cause, so ever present and so pernicious in other respects, that Mr. Stanley's forcible warnings about it should be welcome.

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* "The Congo and the Founding of its Free State; a Story of Work and Exploration." By Henry M. Stanley. 2 vols. London, 1885.

† "What is Malaria?" by C. F. Oldham, Surgeon H.M. Indian Forces. London.

It is amusing to notice that whenever a non-medical writer approaches a medical subject, he seems to fancy that his intuition will guide him to better conclusions than a professional training. I do not grudge the great explorer his fling at the doctors, but I wonder what he would think if in the same spirit some one proposed to show that his long experience of African travel disqualified him from forming a trustworthy judgment on a geographical problem.

In these interesting chapters Mr. Stanley touches another question on which I have already written to you—the use of alcohol. How forcible and faithful is his warning not to drink any "intoxicating beverage, in a tropical country, during the day, except when administered under the direction of medical authority"! And he gives examples of the evil influence of stimulants, and seems to see that, next to chills, they are the most frequent exciting cause of fevers. And yet he recommends the use of wine in the evening! It is difficult to understand the logic which would make a potent poison during daylight become a wholesome beverage as

> "Soon as the evening shades prevail."

I should have been glad to analyse Dr. von Danckelman's valuable meteorological records at Vivi, published in Stanley's book (chap. 36), but time presses—you are going again to Congo, and you have the figures with you and can study them. Perhaps at your several stations you may accumulate other statistics to enable us to form an idea of the climate in other parts of the vast basin of the Congo.

So, good-bye (with all the effect of etymology)

From your Friend,

P. J.

LETTER XXVI.

DYSENTERY.

My dear Friend,—

You do not seem to have met with much dysentery on the Congo, but very likely you may, for epidemics often ravage tropical countries. Many regard it as originating in a miasm closely related to, if not identical with, that which gives rise to the malarial fevers. When once produced it is said to be propagated by contagion—the poison being present in the stools, and as some think in all excretions. Sporadic dysentery occurs in all countries, but mostly in hot summers, is probably due to local causes, and may be excited by disorders of the bowels, irritating diet, impure water, exposure to cold and other noxious agencies. Sporadic cases in temperate climates are usually less severe than true tropical dysentery, sometimes so mild as to deserve to be distinguished as dysenteric diarrhœa.

The striking feature of the disease is witnessed by the old English name "bloody flux." It usually begins as a diarrhœa, which after three or four days becomes more severe and attended with griping pains (tormina), and violent straining or bearing down (tenesmus). This stage may set in with a chilliness and heat or a distinct rigor. The pains get more severe, the calls to stool more frequent and urgent; but only a little watery, slimy or gelatinous matter mixed with blood is passed. At first there may be remains of food in the stools or they may present the characters of simple irritable diarrhœa, but soon they acquire their peculiar appearance, their distinctive offensive odour, and consist mainly of bloody mucus, sometimes nearly pure blood. In grave cases the liquid discharged seems to be a reddish or brownish mucus, in which whitish lumps or shreds resembling raw, minced meat are floating. Sloughs of mucous membrane may also be present, and the smell emitted is most sickening.

The evacuations give little or no relief, and the calls become more and more frequent, so that the patient is attempting to evacuate the bowels every few minutes with great pains and tenesmus, until he seems almost constantly at the night-stool. In mild cases there are ten to twenty discharges a day, and these increase in frequency with the gravity of the case to fifty, sixty, a hundred, or more. In moderate cases the disease continues eight or ten days, usually being most urgent at night, while during the morning the bowels are comparatively quiet. There is little fever, but much weakness and depression. When recovery begins, the evacuations become gradually more natural, the pain diminishes, and some appetite returns.

In more severe cases the evening temperature will rise only to 102° to 103° or 104° Fahr., but the stools become more frequent, the tenesmus more distressing, the dejections more putrid and very irritating, while either early collapse may set in or complications may occur, and the patient sink exhausted.

The dysenteric process may be said to consist of inflammation of the mucous lining of the lower bowels, exudation on the surface, ulceration or sloughing, involving chiefly the superficial coat and the glandular structures.

Chronic dysentery may remain after the acute attack, and is a most intractable disease. It arises from the ulcers formed at first remaining unhealed, and may lead to further complications.

Treatment.—In recent or acute dysentery, keep your patient in bed, feeding him as well as the state of the stomach will admit—a very variable condition—with mild, unirritating, but nutritious food, avoiding whatever leaves a good deal of residue. The drinks should be lukewarm, as they are less provocative of peristaltic action than cold.

If you have the least reason to believe that there is any accumulation of irritating matter in the bowels, clear them out with a dose of castor oil, rhubarb and magnesia, or other aperient—the less irritating the better. A little laudanum or Dover's powder may be added. In quite mild sporadic cases, brought on by errors in diet, it may suffice to remove accumulations from the bowels, and then give a few small doses of Dover's powder or other opiate, insisting on rest and appropriate food.

In severe cases this will not suffice. The remedy which is held to be most effective is ipecacuanha—the simple powder—which many physicians of large experience in the tropics regard as specific. They advise 25 or 30 grains in a small quantity of liquid. The patient must then keep as quiet as possible, and refrain from drink for three hours or more, sucking ice if very thirsty. In eight or ten hours a second dose, smaller in proportion to the effect of the first, may be given. The medicine will then be repeated according to the urgency of the case. A few give larger doses, while others prefer smaller quantities repeated frequently. A full dose of laudanum or a subcutaneous injection of morphia is sometimes advised, to enable the stomach to tolerate the ipecacuanha. Counter-irritation to the stomach and hot fomentations also give relief. On the Congo you should regard dysentery as malarious, and therefore combine quinine with other treatment. Astringents have been often recommended, but are of little use.

The anus and skin around should be gently sponged after each motion with warm water, to which may be advantageously added a small quantity of a non-irritant disinfectant such as Condy's fluid.

In **chronic** cases rest is perhaps the most important point—repose of the whole body and as much rest as practicable for the bowels, by the use of only bland, nutritious food. Great attention should be paid to the hygiene of the person and his surroundings. Warm clothing is important. Dover's powder may be used with quinine and perhaps tincture of perchloride of iron may be found useful. A return to a cold climate or a sea voyage is desirable.

Prevention.—In a sudden outbreak or an epidemic the question of contagion assumes importance. Disinfection of houses, clothing, linen, &c., should be thoroughly carried out. That the discharges may be thoroughly disinfected, the night-stool into which they are passed may be kept charged with carbolic acid or chloride of lime.

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LETTER XXVII.

CONSTIPATION—DIARRHŒA.

My dear Comber,—

A word about constipation and diarrhœa, because either of them, through neglect or injudicious treatment, may bring on dysentery, and both are common disorders.

Constipation arises from imperfect peristaltic action, or from deficiency of secretion; also from the effect of the dietary and of the quinine and other medicine.

Change of diet is a natural remedy for this condition. Oatmeal is an excellent article in sluggish intestines—so try porridge. Figs, dates, oranges, bananas, and other fruits are also desirable. A good proportion of fresh vegetables should be taken, and salads may be beneficial.

A glass of water last thing at night or first thing in the morning will often be sufficient to obviate the constipation.

When there is general want of tone, tonics may be needed; but a good deal of discrimination should be exercised in respect to tonics, as most of them are somewhat constipating. In anaemic persons, small doses of the least astringent preparations of iron are proper. Quinine, too, is often desirable at the same time. Citrate of iron and quinine will then suit, or reduced iron with quinine in a pill with extract of nux vomica. Arsenic is another tonic of great value to many.

When it only seems necessary to stimulate sluggish peristaltic action a dose of tincture of nux vomica may be taken for a week or two. An enema of cold, or nearly cold, water may be tried every morning for a time, and the habit cultivated of evacuating the bowels regularly. Frictions and kneadings of the abdomen will often set up the movement.

You see I do not talk of purgatives. Try to do without them. It is important not to irritate the bowels in hot climates. If you must resort to aperients, choose the mildest in small doses, and combine them with tonics or take a tonic at the same time. Thus, a dinner pill containing ½ a grain or 1 grain of aloes, with 2 grains of quinine and a ¼ grain of extract of nux vomica may be taken regularly for two or three weeks. A grain of reduced iron may be added if indicated; or dialysed iron or other tonic may be taken twice or three times a day, and a mild aperient at bed-time or in the morning. A teaspoonful of castor oil taken every night will often bring about a regular action; but it is not nice. Sulphur will do as well, and 5 grains, if taken every day, will often be enough. It may easily be taken in water, or, if preferred, the confection may be used. Epsom salts (sulphate of magnesia), or Glauber's salts (sulphate of soda), may be substituted, or the two taken together—5 grains of each in half-a-pint of warm water every morning. The juice of a lemon or a little citric acid, with some sugar, added to this draught, makes it a palatable aperient lemonade or sherbet. This may be continued every morning for two or three weeks, taking it before breakfast, and frequently a course of this kind will bring about a healthy and regular action. The dose, you see, is small; with these salines the more they are diluted the more freely they act —within certain limits. When the evacuations are deficient in colour you may try podophyllum, and in this case a minute dose of tincture daily for a week or two is better than occasional larger doses in pills. Extract of jalap, rhubarb, or aloes are suitable for pills; but, in these again, small doses every night are most likely to establish a regular habit, and so enable you to discontinue the medicine. Arsenic tends to irritate the bowels, and, therefore, does not usually require any aperient as a corrective; but quinine and iron generally do.

Diarrhœa should never be neglected. If you suspect it to arise from undigested food or accumulation of any irritating material, the best plan is to empty the bowels by a mild aperient, and follow that up with a dose of Dover's powder: rhubarb and magnesia, or tincture of rhubarb or castor oil will suit best. Rhubarb is considered to act as an astringent after the aperient effect has passed by, and is therefore specially suited for such a purpose.

The magnesia is antacid and aperient. The alkaline effect can be obtained by carbonate of soda quite as well. Rhubarb is most effectual in powder, but very nauseous. The compound tincture is carminative also, but sometimes the amount required contains too much spirit. Infusion gives a clear liquid which you can mix with fluid magnesia, or, in the absence of this, a few grains of carbonate of soda will make the dose alkaline. You can give the dose of Dover's powder as soon as the aperient has acted.

If this treatment does not suffice, chalk mixture may be given, with opium or not, according as there is much pain. Bismuth is more suitable than chalk when there is nausea or derangement of the stomach as well as the bowels; 10 grains of carbonate of bismuth, with 5 or 10 of powdered acacia or of compound tragacanth powder and 20 minims of spirit of chloroform in an ounce of water makes a nice dose, which is very soothing. Cinnamon or peppermint water may be used if preferred. Aromatic chalk powder can also be added if desired; or if alkalies seem indicated, some carbonate of soda: a few doses of this last may be taken separately.

If these do not suffice, you can also give opium, say five minims of laudanum, in one ounce doses of chalk mixture, with half-a-drachm of tincture of catechu in each, or one of the other astringents present in your medicine chest; or you may give the aromatic chalk, or bismuth mixture frequently, and the opiate at longer intervals

Dover's powder, in pill, will be easily taken as required, and the amount of opiate thus administered will not depend on the frequency of the doses of the mixture.

Rest in bed, with milk or farinaceous diet, especially rice (beef tea is apt to provoke diarrhœa), and a little lime water, or a few doses of carbonate of soda or bismuth, will often suffice, but sometimes neglected diarrhœa becomes an obstinate chronic malady, or brings on worse diseases.

You see how important it is to maintain the digestive system in a healthy condition. The way to do this is by wholesome, nutritious diet, and by observing the hygienic precautions I have previously enjoined upon you. In your turn enjoin them on all your band, and believe me to remain, always,

Your sincere friend,

PROSSER JAMES.

3, Dean Street, Park Lane,
August 8, 1885.

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